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What are the reasons for replacing obsolete equipment?
How soon should new equipment pay for itself?
What are the steps taken in buying equipment?
Is group or individual motor drive preferable?
Is a repair cost record worth while?
How are obsolete machines disposed of?
What are the faults of machine tools?
How keep informed of developments in equipment?

Conclusive answers to these questions are of extreme importance to the user of shop equipment. The answers have been given in the *American Machinist* in its series of articles, "Getting the Most Out of Your Machine Tool Dollar." But not all of the leaders of the machinery industries think alike on such subjects and the problems are likely to require different answers in different plants. Therefore cross-sections are presented here of the articles as a whole, the statments of company policies being quoted or abstracted, as they apply to the several questions.

In this article, the SECOND *of a series of eight, answers are given to the question*

How Soon Should New Equipment Pay for Itself?

Illinois Central—No specific time is set by the Illinois Central Railroad as the maximum to be allowed for the investment in a machine to be repaid by increased earnings. The policy is set forth by the General Supervisor of Machinery and Tools as follows: "The variables entering into the consideration by railroad repair shops of the replacement of machines are many. There are the varieties and sizes of work; small quantities; irregularities in demand on the shops; size of the shop; necessity for returning the locomotive to service in the shortest possible time. All of them must be considered when saying 'yes' or 'no' on replacements and new equipment. No hard and fast rule can be set. Each old machine up for consideration must be weighed with the new, and there are times of uncertainty and times when the old machine stays in. But such cases are more infrequent as methods and tools improve and as we gather more complete data on the cost to us of obsolete machinery."

International Harvester—"Nor do we set a rigid limit to the time during which a replacement machine must pay for itself," says the International Harvester Co. "Two years is considered a favorable period and a time as long as five years is likely to be frowned upon. But there is no iron-clad rule, as witnessed by some recent appropriations for replacement machines that are not likely to pay for themselves under four years."

SKF Industries—According to SKF Industries it is not feasible to set a time limit of one, two, or three years. Inclination is toward the two-year period, with reservations. Usually two years are considered enough for a machine tool, when the savings consist of productive labor alone.

Delco—Because of yearly changes in the automotive industry, making probable changes in its product, Delco (Dayton Engineering Laboratories Co.) has found that one year is the safe length of time to allow for wiping out its initial expenditures for equipment.

The Hoover Co. allows two to three years.

Timken—Less limiting is the Timken Roller Bearing Co. According to the Assistant Factory Manager, "We will replace even a new machine by another if the replacing machine will pay for itself in a few years, when the calculations are based on cost alone. There may be other considerations that will make advisable the allowance of a longer time for our money to come back."

Corona—A two-year period is favored by the Corona Typewriter Co.: "If it can be shown that the purchase of a machine will result in savings that would cover the purchase price and interest in a period of two years, it would have an immediate appeal." However, the two-year period may be exceeded: "If the machine had a utility beyond the immediate reasons for purchase it would be a factor weighing in its favor and against a single-purpose machine. We like such flexibility."

Grand Trunk—The more liberal attitude of the Grand Trunk Railway System is indicated by this statement of its Shop Superintendent: "Before asking for a new machine, we estimate the saving to be secured, and if we can feel sure of a reduction of 15 per cent in the cost of work, we consider the purchase justified. This means that the new machine should pay for itself in between six and seven years, which we think is a fair basis, even though many machine tools in a railroad shop last from fifteen to twenty years with good care."

Spicer—One year is the limit set by the Spicer Manufacturing Co.: "It has been our experience that if we work long enough at the job we can discover a machine and a method that will produce the desired result and meet our one-year requirement."

Hupp—It is the practice of the Hupp Motor Car Corporation to require a new machine to earn its cost in one year, or at the most eighteen months. Style changes in automobiles are responsible for this policy. The Hupp corporation considers single-purpose tools as a last resort, and insists that they pay for themselves during a standard run of 10,000 to 15,000 cars.

Western Electric—The common metal manufacturing machines of the Hawthorne Works of the Western Electric Co. are expected to return their cost within one or two years. Where the installations are more extensive the period is extended to as much as five years.

National Cash Register—There was a time when the National Cash Register Co. followed the one-year policy. "It is a policy to which we did not adhere," says the Superintendent. "We found that many innovations would not have happened had we done so."

Gleason—The nearest that the Gleason Works can come to setting a time limit is to say that equipment must pay for itself within a short period of years. The company feels that consideration must be given to quality of product and to ease and convenience of operation, as well as to actual production time.

Morgan—It is the aim of the Morgan Construction Co. to buy the equipment that will return the greatest profit. Yet complications arise because of short runs and because of differences in design among the machines built by the company. Hence compromise, in buying, to provide machines that will do two or more kinds of work, is frequently necessary. "Because of the difficulty just outlined," says the Vice-President, "we follow a general policy, which is in effect to keep informed of all new equipment and to spare neither time nor expense in purchasing such equipment as will enable us to secure the best investment, as nearly as can be determined. In line with this policy, it is apparent that we cannot set a time as the minimum during which any machine bought must return the initial expenditure from increased earning."

It is hard to imagine a single power unit that requires the energy of 30 tons of coal an hour, or 1,000 lb. per minute. But such a machine is in use by the New York Edison Co. in one of its stations. And this one machine would have supplied all of New York's current in 1906—only 20 years ago.

Welding High-Chromium Steels

By Stanley M. Norwood

THERE are many difficulties inherent in the welding of alloys containing more than 10 per cent of chromium. The most serious problems are those of brittleness in the weld and in the the base metal adjacent to the weld. This brittleness cannot be relieved by heat treatment in alloys containing 20 per cent or more of chromium. In recent years marked advances have been made in the development of alloys resistant to pressure, temperature and corrosion, and among such alloys, those containing 10 per cent or more of chromium have become particularly prominent.

Gas welding has been most commonly employed for chromium alloys, and it is usually done with a reducing flame, that is, with an excess of acetylene. Such a flame makes welding much easier for these particular alloys, but it has the disadvantage of introducing carbon into the weld, resulting in hardness, lack of ductility and difficulty in machining. Electric welding is also being successfully applied to these alloys.

The welding of high-chromium alloys gives rise to infusible oxides, which are difficult to float to the surface of the weld, and unless removed constitute points of weakness. Fluxes have recently been developed that operate satisfactorily in slagging off these oxides and protecting the metal from excessive oxidation during welding. These fluxes permit the use of a neutral flame in gas welding, while they improve electric welding by yielding a clean, dense deposit.

In the alloys consisting chiefly of chromium and iron, other difficulties become apparent after a weld is completed, notably a lack of ductility in the weld metal and in that portion of the plate metal adjacent to the weld. In alloys containing not over 20 per cent of chromium, this brittleness can be remedied to some extent by heat treatment, but this method may not always be applicable, because of the size of the construction.

The remedy is to be found not so much in a departure from the present method of welding as in an improvement in the composition of the alloy. The addition of about 8 per cent of nickel to high-chromium alloys has been found beneficial, since it refines the grain and improves the ductility and shock resistance, while at the same time it prevents the development of brittleness after welding. It also improves the welding qualities of the alloy. Nickel, however, has a tendency to diminish the resistance of the alloys to corrosion by certain media, such as sulphur dioxide.

This objection has been offset by increasing the silicon in the alloy to about two per cent. The addition of nickel, when accompanied by silicon, is found to have no adverse effect on the resistance of the alloy to dilute nitric acid and to oxidation at high temperature. In fact, the effect appears to be slightly in the opposite direction.

It has also been found that if the percentage of manganese is made approximately equal to that of silicon, it is not necessary to use a flux-covered rod, since the products of oxidation are then self-slagging. These additions to the high-chromium alloys have been found to solve most of the difficulties that have been encountered in welding, while at the same time giving a ductility to the welded article without heat treatment.

Abstract of a paper presented at the meeting of the American Electro-Chemical Society in Washington, Oct. 7-9, 1926.

Flower garden route of the Great Northern

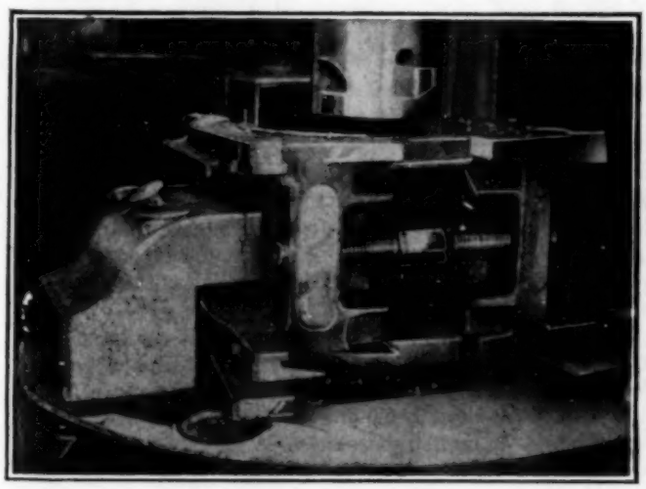
Landscape decoration at entrance to shops at St. Paul, Minn., which visualizes by means of flowers and shrubs the route of the Great Northern Lines. The employees of this shop defray the expenses of this decoration

A Miscellany of Tools at the Great Northern Shops

By Frank W. Curtis
Western Editor, *American Machinist*

AMONG other devices seen at the St. Paul, Minn., shops of the Great Northern Ry. Co., is the fixture for boring oil cellars in the Bullard driving-box boring machine, as illustrated in Fig. 7. The fixture is made from an obsolete driving box, cut in two, a portion of the top section being removed. The two side members are connected by slides in the upper and lower faces. The fixture rests on two parallels located between the jaws of the driving-box chuck. The cellar is placed in the fixture and is clamped both by the chuck jaws and the right- and left-hand screws, one of which is

Conclusion. The first part was published on page 819.



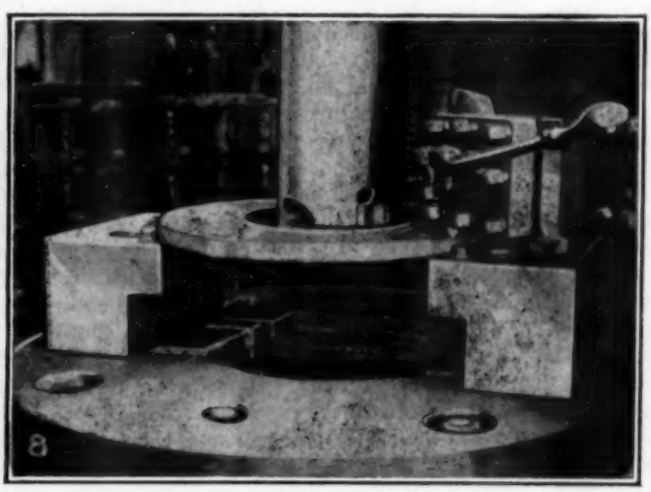
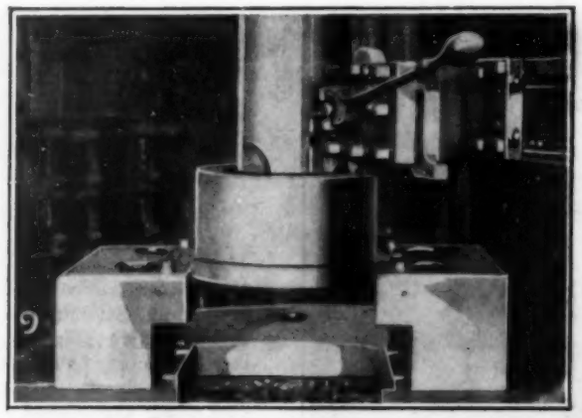
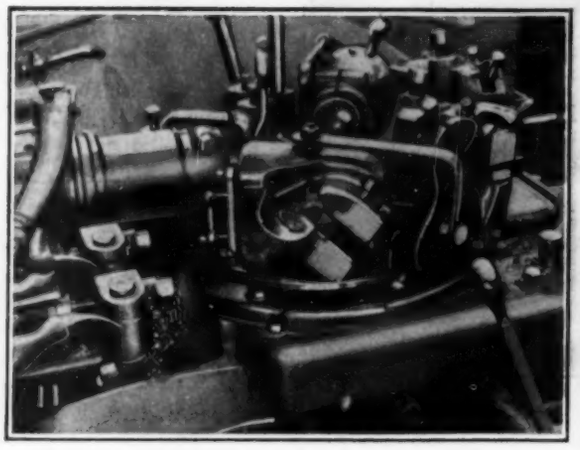


Fig. 7—Boring mill used for machining oil cellars. Fig. 8—Boring and facing hub liners on the same machine





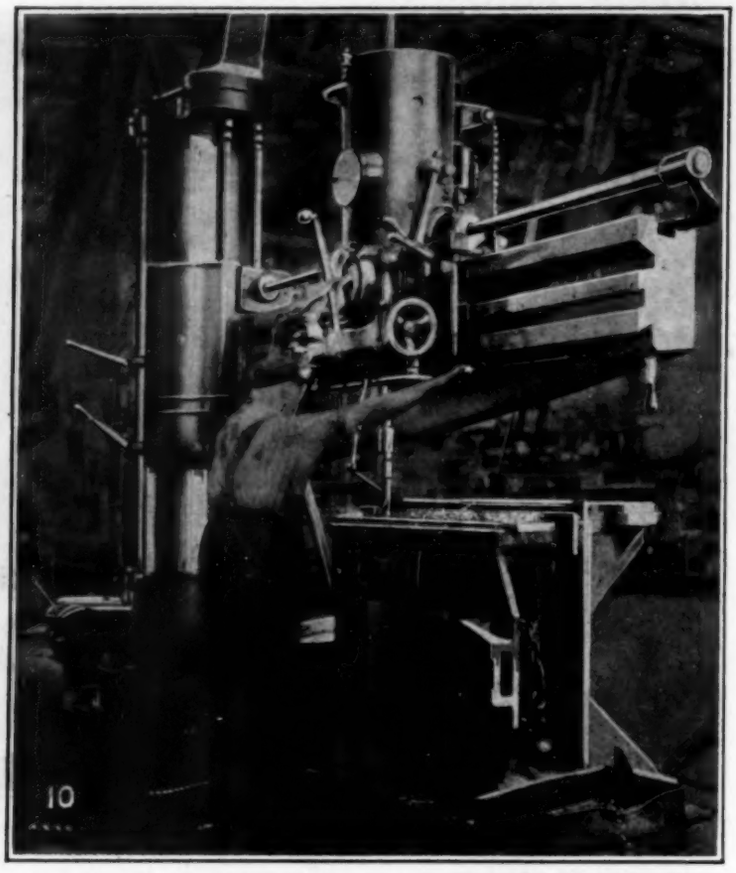


Fig. 9—Machining a cast-steel connecting-rod bushing. Fig. 10—Radial drill for heavy work. Fig. 11—Cutting rollers in a turret lathe

shown in the front of the fixture. The operation ordinarily is handled in a vertical boring mill, but since this machine is not kept busy on driving-box work, the oil-cellar work helps to keep it in constant use.

Another set-up in the same machine is shown in Fig. 8, in which can be seen a bronze hub-liner being bored and faced. The work rests on the upper faces of special jaws, pins being provided between which the work is clamped. The faces of the pins are beveled so as to hold the work down firmly. The bore, part of the outside diameter, and one side are machined after which the work is reversed so that it can be faced on the opposite side and the remainder of the outside can be turned. The jaws are arranged also for the machining of floating bushings used in connecting rods. In Fig. 9 is shown a cast-steel bushing as it is chucked for the first setting. The flange fits a counterbored section of the jaws, providing a seat for the bottom face of the work. The inner faces of the jaws are serrated. The bushing is bored to 10 in., the body turned to 12¾ in. and faced on the upper end. It is then reversed in the chuck, being held by the body for machining the flange.

One of the most recent additions to the machine-tool line is the Cincinnati-Bickford master radial-drill shown in Fig. 10. The machine is driven by a 30-hp. motor, and handles such work as frames, drawbars, connecting rods, and other large-sized units. By using a jig, air-pump cylinders are bored in the machine. Through the power available and the rigidity of the arm, the machine has made possible a reduction in machining time on many units. The work shown in the machine is a steel saddle casting for a Mallet compound engine. Jig plates, clamped on the work, are used to locate the position of the holes. The holes are back counterbored from below for bolt heads, in the same setting. The machine is so located next to the main aisle of the shop that the work table lies in a path of an overhead crane. This feature facilitates loading, since the machine is intended

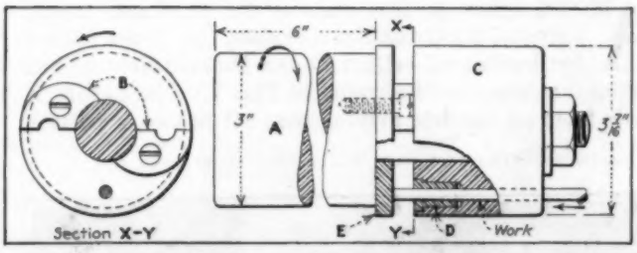


Fig. 12—Constructional details of the cutting tools

for heavy work. The height of the foundation is such that the base of the machine is level with the floor, thereby eliminating excess lifting in placing heavy work. Both the column and the arm of the machine are equipped with air-operated locking devices, controlled from the drill head, thus eliminating the time usually consumed in hand clamping.

Sliding doors of box cars are equipped with roller-bearing hangers. The rollers are made of cold-rolled steel, and are ¼ in. in diameter and ½ in. in length. At this shop more than 150,000 rollers are used yearly for repair work. The method shown in Fig. 11 is used for making the rollers, and a year's supply is turned out in less than a day. A Jones & Lamson flat-turret lathe is equipped with two rotary knives in the spindle and a

stationary knife in one of the turret tool holders, so that as the rod is pushed through a bushing behind the stationary knife, the rollers are cut off by the rotating knives and fall in a chute under the spindle. Approximately 36,000 pieces per hour are made by a single operator.

In Fig. 12 are shown constructional details of the cutting tool. The rotating member *A*, attached to the machine spindle, is equipped with two knives *B*. The front end of this member has a pilot fitting in the stationary unit *C*. The bushing *D* is arranged so that it is aligned with the knives, as shown. As the rod is fed through the bushing, it strikes the hardened plate *E*, and the end is cut off as soon as one of the revolving knives strikes it. Two rollers are made at each revolution of the spindle. The work is cut without flattened sides, as is usually the case when a flat shear is used. This feature is made possible by the half-round grooves in the knives.

In the headpiece is shown a variation from machine work, although it represents work in which great pride is taken by the employees. At the entrance to the shop a piece of ground has been laid out to resemble the route of the Great Northern lines. Elevations and locations of the principal points of the road are reproduced to scale. Plants and shrubbery are arranged to simulate the characteristics of the country through which the road passes. The track system is represented by rows of plants of a light color. Small signs are used to signify the larger cities. The 20,000 plants used are grown in the hot house shown in the upper right-hand corner. The cost of the work is defrayed by popular subscription from the employees. The decoration gives an air of distinction to the entrance of the shop grounds.

Employees Should Be Warned

By Leslie Childs

THE adjusting, cleaning and repairing of machinery while it is in motion, is one of the most prolific causes of accidents in the industrial world. The history of cases of this class will bear out the assertion that employees of experience with full knowledge of the danger involved, will frequently become victims of accidents of this character.

An employee may work upon a simple machine for months or years. He may know full well that if the machine becomes clogged, requires adjusting, cleaning or repairing, then the safe way of doing the work is to stop the machine. And yet, to save a moment's time or for personal convenience, he may take chances and clean the machine while it is in motion.

If an accident occurs, however, it is dollars to doughnuts that the employer will be called upon to respond in damages upon the grounds of his failure to warn the employee of the danger in cleaning machinery while it is in motion. The question of an employer's duty in this respect, therefore, becomes one of considerable importance.

In the first place, at law the employer is in duty bound to warn an employee of such danger if he has the superior knowledge of its presence. On the other hand, if the danger is obvious and equally within the knowledge of the employee, there will be no duty of this kind upon the employer. The application of this rule and the reasoning upon which it is based is aptly illustrated in the North Dakota case of Hanel vs. Obrigekewitsch, 168 N. W. 45, which arose as follows.

The plaintiff was employed by a mill owner to operate a grain grinding machine. He was an intelligent man, thirty-nine years of age and at the time of the accident out of which this action grew, had been operating the machine about three and one-half months. The machine was fitted with three sets of rollers which were covered by iron doors. In order to get one's hand into the rollers it was necessary to raise the doors.

The proper way to repair, adjust or clean the machine was to throw off the belt or to stop the engine. But the plaintiff, instead of using this method, attempted to clean the rollers when they became clogged, without removing the belt or stopping the engine. When the plaintiff inserted his hand between the rollers in order to clean them two of his fingers were crushed.

For the injury suffered the plaintiff brought the action against the employer for damages. This action was based on the allegation that the employer had failed to warn him of the danger in cleaning the machine as he had attempted. Further, the plaintiff contended that he had seen the employer clean the machine in this manner and that it was his duty to warn him against it. This contention raised the question as to whether the employer had failed in his duty, so as to render him liable for the plaintiff's injury.

The trial of the case resulted in a judgment in favor of the plaintiff. The employer prosecuted an appeal and the higher court in stating the question before it said, "Is it negligence for an employer to fail to warn an employee of a danger that is so obvious that one of his age and experience should readily realize it, and refrain from a practice which such employee must realize is fraught with danger?

"We realize that there are cases where an employee is entitled to rely upon the superior knowledge of his employer. Even, however, if the action of the employer in cleaning the roller in the way that he did could be construed to be an instruction, it can hardly be believed that he had any superior knowledge in this respect. * * *

"The plaintiff himself testifies that there was a way to stop the rolls and to thus clean the machinery with safety, and that was either to throw off the belt or to stop the engine. The question is not one of contributory negligence, merely. The case comes within the rule that there is no duty of warning and instruction if the employee's duties are simple and the danger obvious, or if, by other means, he possesses knowledge of the risk to which he is subjected.

"The rule requiring the employer to instruct his employee and to warn him of danger is only for the purpose of supplying him with information which he is not presumed to have and if it is shown that the employee did, in fact, possess the knowledge, the failure to warn can in no sense be said to be the proximate cause of the injury * * *. The employee is presumed to see and to understand all dangers that a prudent and intelligent person of the same age and experience, and with the same capacity for estimating their significance, would see and understand. 18 R.C.L. 569, 570 * * *."

Book Reviews

Principles of Accounting. By Eric L. Kohler, professor of accounting, Northwestern University, and member, Kohler, Pettengill & Co.; and Paul L. Morrison, assistant professor of finance, Northwestern University, and member, Kohler, Pettengill & Co. Four hundred and thirty-one pages, 5x8 in.; flexible covers. Published by the A. W. Shaw Co., Chicago, Ill. Price $5.

This book was written for general readers as well as students of courses in accounting. The authors have succeeded in preparing a treatise in which the information is presented clearly, logically, and fully.

The five sections, consisting of 28 chapters, take up (1) the fundamental theory of debit and credit journalizing, posting, taking the trial balance, and preparing the six-column statement; (2) divided books of original and final entry; (3) the adjustments leading up to and following the financial statements; (4) the various phases of corporate accounting procedure; and (5) the significance of assets and liabilities, and their relationships to each other, among other analyses and interpretations.

Commercial and Industrial Organizations of the United States. Department of Commerce, Domestic Commerce Series—No. 5. One hundred and ninety-one pages, 6x9 in., heavy cloth boards. Published by the Government Printing Office, and sold by the Superintendent of Documents, Washington, D. C. Price 60 cents.

This publication, which is a revised sixth edition of what was originally called Miscellaneous Series No. 99, lists approximately 9,000 commercial and industrial organizations or associations made up of 1,199 interstate, national and international, 1,130 state and 6,449 local organizations. These lists do not include governmental, educational, professional, civic, agricultural or religious organizations or associations.

The address of the headquarters office of each of the organizations is given and the date of the annual meeting.

In addition to the alphabetical list, there is a separate classified section in which the organizations are listed according to their functions as retailers, wholesalers or manufacturers.

The New Leadership in Industry. By Sam A. Lewisohn, vice-president, the Miami Copper Co.; and chairman of the board, the American Management Association. Two hundred twenty-nine pages, 5x8 in., cloth boards. Published by E. P. Dutton & Co., 681 Fifth Ave., New York City. Price $2.

Mr. Lewisohn considers that "the factor of efficiency, in the present state of the industrial world, must be the most prominent, if not the determining consideration, in evolving new principles of organization." It is pointed out that the labor problem is not peculiar to capitalism; that autocracy exists as a human and social trait; that labor unrest exists in small as well as large-scale organizations; that sabotage is, in a way, universal; that men object to exploitation, particularly by money power, but that capitalist production has brought a vast amount of goods and services to the masses.

Having given an unbiased and sane accounting concerning the points referred to, with the objective of placing them in their proper perspective, Mr. Lewisohn then focuses the attention upon the individual plant, where the daily contact between employer and employee takes place, which, he says, is the starting point of any endeavor to improve industrial relations. He deals with the mental hygiene of employees, the education of the manager, the employer's responsibility to the community, employee representation as an aid to management, harmonizing unionism and industrial effectiveness, and the modern employer's wage policies.

The real difficulty of labor relations," he says, "has been one of neglect," and, "There are limits to what an individual employer can pay in wages, but the only limits with respect to personnel and other problems of management are his intelligence, ability and good-will."

In referring to the opportunity of the new leadership, Mr. Lewisohn emphasizes the growing importance of industrial activity to a large section of the population, and hence to harmonious national existence. "From one point of view," he says, "the factory is the melting pot of the nation." The adoption of the right methods of conducting industry and the tactful and effective supervision of employees will make the workers appreciate the importance of brains and leadership in our industrial structure. This will mean more for national stability than any artificial propaganda. There is as much opportunity for statesmanship in the industrial field as there is in the political field."

Mr. Lewisohn's book is a sane and constructive analysis of the factors affecting personnel relations in industry.

The Better Wage. This booklet is an analysis of group bonus labor payment, and was prepared and published by Ernst & Ernst, 80 Maiden Lane, New York City. The book contains twenty-six 6x9 pages with half-cloth binding. It takes up the subject of labor as an element of manufacturing costs, and attempts to show how the application of a system of group bonus reduces labor losses from carelessness, incompetence, and shirking. It also shows that through the group bonus plan the call of labor for shorter hours without reduction in pay has possibilities of being met. The booklet is for free distribution to interested executives.

The Mission and the Needs of the United States Navy. This 6x9-in. booklet contains a hundred and thirty-five pages of articles and addresses reprinted from the Proceedings of the United States Naval Institute. The first article, on the economic dependence of America on foreign trade, shows the need of attention on the part of manufacturers and business men to the problem of the maintenance of a merchant marine and an adequate navy. The other articles have to do with existing conditions and problems in the navy and in the merchant marine. The booklet is published by the United States Naval Institute.

The Merchants Association of New York, Year Book, 1926. This book, which is made up of three hundred thirty-two $6\frac{1}{2}$x$9\frac{3}{4}$-in. pages, contains a complete directory of all members of the Merchants' Association of New York arranged by classification as well as alphabetically, and is cross indexed. The list contains the names of 6,908 firms, and is claimed to be a representative cross-section of the business of the city.

Tools for Building Railroad Cars

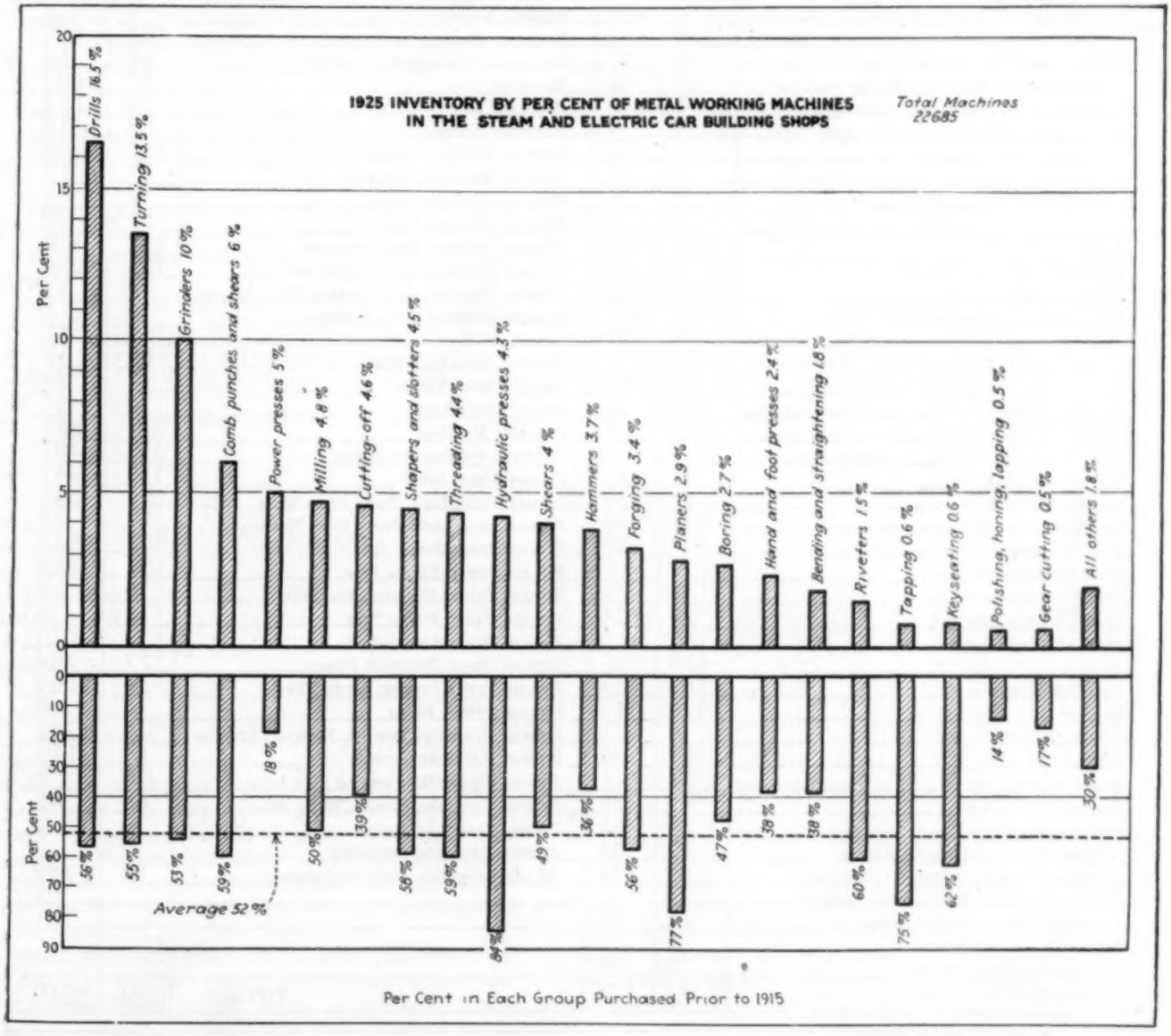
The quantity, type and age of metal working equipment in the steam and electric car-building plants

THERE are 138 plants employing 6 or more workers, and 80,586 workers engaged in building cars, freight, passenger and express, for the steam and electric railroads, according to the U. S. Census of Manufacturers for 1923. There are nearly 22,700 metal-working machines of various types and of varying ages in active service in these plants, according to the computed returns from a questionnaire recently sent by the *American Machinist* to this branch of industry.

The division of these machines into groups is given in terms of per cent of the total in the chart shown below. The per cent of machines in each group, that have seen ten years or more of service, is also given. An average line is drawn at 52 per cent.

On the following page the body of the original questionnaire is reproduced and is filled in with the totals on which the chart was based. These totals were obtained by expanding the actual figures returned on the questionnaires as follows:

The returns were totaled as to machines and as to men in the plants reporting. The balance between men and machines was then computed and used, with the Census of total men to arrive at total machines.



METAL WORKING EQUIPMENT IN THE STEAM AND ELECTRIC CAR BUILDING PLANTS

Kind of Machine Tool	A Number Built Before 1918	B Total Number in Plants 1925	Kind of Machine Tool	A Number Bui. Before 1918	B Total Number in Plants 1925
Engine Lathes	1088	1615	Grinding Machines, Floor, No Feed Attachments	816	1360
Hand Turret Lathes	51	119	Grinding Machines, Bench, No Feed Attachments	68	136
Power Turret Lathes	204	357	Grinding Machines, Disk	153	221
Semi-Automatic Lathes	34	85	Grinding Machines, Belt	0	17
Hand Screw Machines	0	17	Grinding Machines, Centerless	0	85
Automatic Screw Machines, Single Spindle	85	170	Polishing and Buffing Machines, Wheel	17	102
Automatic Screw Machines, Multiple Spindle	0	0	Polishing and Buffing Machines, Belt	0	17
Chucking Lathes	0	51	Polishing and Buffing Machines, Semi-Automatic	0	0
Multiple Spindle Chucking Machines, Rotary Work	0	0	Lapping Machines	0	0
Multiple Spindle Chucking Machines, Rotary Tools	0	0	Honing Machines	0	0
Speed Lathes	0	68	Cutting-Off Machines, Parting Tool Type	51	68
Bench Lathes	0	0	Cutting-Off Machines, Power Hack Saw Type	255	680
Tool Room Lathes	102	357	Cutting-Off Machines, Rotary Cold Saw Type	51	187
Wheel Lathes	51	51	Cutting-Off Machines, Band Saw Type	17	51
Axle Lathes	102	204	Cutting-Off Machines, Friction or Hot Saw	34	68
Forge Lathes	0	0	Shears, Knife	357	697
Hand Milling Machines	34	119	Shears, Rotary	68	109
Bench Milling Machines	0	0	Shears, Slitting	17	102
Plain (Knee and Column Type) Milling Machines	153	408	Nibbling Machines	0	0
Universal (Knee and Column Type) Mill. Mach.	119	272	Hammers, Steam	109	459
Vertical (Knee and Column Type) Mill. Mach.	34	85	Hammers, Pneumatic (not portable)	68	85
Lincoln Type Manufacturing Milling Machines	68	68	Hammers, Drop	51	102
Semi-Automatic Type Milling Machines	0	0	Hammers, Helve	51	153
Continuous Mill. Mach. Rotary or Drum Type	0	0	Hammers, Spring	17	34
Planer Type Milling Machines	136	136	Riveting Machines, Pneumatic	170	306
Gear Cutting Machines, Rotary or Milling Type	17	68	Riveting Machines, Hydraulic	17	17
Gear Cutting Machines, Hobbing Type	0	34	Riveting Machines, Steam	0	0
Gear Cutting Machines, Planing or Shaping Type	0	0	Riveting Machines, Power	17	17
Vertical Boring Mills	170	459	Forging Machines, Hot, Bulldozers	221	476
Horizontal Boring Machines	119	153	Forging Machines, Hot, Forging Machines	153	238
Radial Drilling Machines	459	629	Forging Machines, Cold Headers, Bolt, Nut, etc.	51	51
Upright Drilling Machines, One Spindle	1037	1921	Forging Machines, Cold, Swaging	0	0
Upright Drilling Machines, Two or More Spindles	187	357	Bending Brakes	68	187
Upright Drilling Machines, Two or More Heads	153	323	Bending Rolls, Horizontal	68	136
Sensitive Drilling Machines, One Spindle	153	374	Bending Rolls, Vertical	17	34
Sensitive Drilling Machines, Two or More Spindles	102	136	Straightening Rolls	0	51
Sensitive Drilling Machines, Two or More Heads	0	0	Punching Machines	391	833
Two-, Three- and Four-way Drilling Machines	0	0	Combined Punches and Shears	391	493
Tapping Machines, Single	51	85	Presses, Hand, Arbor	119	221
Tapping Machines, Multiple	51	51	Presses, Hand, Light Punch Press Work	51	238
Pipe Threading and Cutting Machines	187	306	Presses, Foot, Light Punch Press Work	17	34
Bolt Threading and Cutting Machines	374	629	Presses, Power, Crank Type	102	527
Thread Chasing Machines	0	0	Presses, Power, Toggle Type	51	136
Thread Hobbing Machines	0	17	Presses, Power, Double-Acting Type	0	0
Thread Milling Machines	17	34	Presses, Power, Dieing Type	0	0
Thread Rolling Machines	17	17	Presses, Power Automatic	0	170
Planers	408	527	Presses, Power, Trimming Presses	17	204
Open-side Planers	102	136	Presses, Power, Forcing, Arbor, Wheel	34	102
Shapers	408	765	Presses, Power, Baling	0	0
Vertical Shapers	0	17	Presses, Hydraulic, Bending, Forming, Drawing	714	782
Slotters	187	238	Presses, Hydraulic, Forging	51	119
Broaching Machines	0	17	Presses, Hydraulic, Flanging	0	0
Keyseating Machines	85	136	Presses, Hydraulic, Forcing, Wheel, etc.	68	85
Centering Machines	34	85	Presses, Hydraulic, Baling	0	0
Grinding Machines, Plain Cylindrical	17	34	Presses, Hydraulic, Extruding	0	0
Grinding Machines, Universal Cylindrical	85	136	All other machines and miscellaneous	85	289
Grinding Machines, Surface, Reciprocating	17	51			
Grinding Machines, Surface Rotating	0	68			
Grinding Machines, Internal	0	17			
Grinding Machines, Cylinder	0	34			
Grinding Machines, Cutter	85	170	TOTALS	11856	22685

A Set of Tools for Making Laminations

By Ellsworth Sheldon
New England Editor, *American Machinist*

Scrap material reduced to low percentage—Felt washers carry lubricant to pillars—Accurate feeding and piloting—Means for stacking the punchings

THE set of tools here illustrated produces a stator and a rotor lamination for the magnets of a small motor at one stroke of the press. It is not a compound tool, yet both parts are blanked from the same strip of stock at the same time; the lamination for the stator being taken from the area surrounding that for the rotor.

When parts of this kind are taken out by compound tools, as in many cases they are, there is no provision for clearance between the rotor and the stator, and an after operation of broaching the stator or grinding the rotor—or both—after assembly is necessary to provide it. In the product of these tools this clearance is already provided.

In Fig. 1 is shown the appearance of a strip cut from the stock as it lies in the tools, the dotted outlines indicating where the stator lamination is to come out at the final step. It will be seen that the percentage of scrap is very low, considering the somewhat complicated shape of the parts. The upper row of outlines in this figure show the rotor, the scrap and the stator progressively.

At the third step, provision is made for clearance between the rotor and the stator by trimming out a very narrow ring of stock surrounding the opening from which the rotor is blanked at the second step. The lamination stock is of 0.021 in. gage, while the thickness of the ring removed, measured widthwise of the stock, is but 0.010 in. The trimming punch is piloted at this step by a projection having the full diameter of the opening left by the punch that blanks the rotor. Accurate piloting is imperative, not only because of the very narrow section of the stock removed at this point, but also because of the fact that the contour of the opening produced by this punch must blend nicely into the four egg-shaped holes made by the piercing punches at the first step, in order to complete the inner contour of the stator lamination.

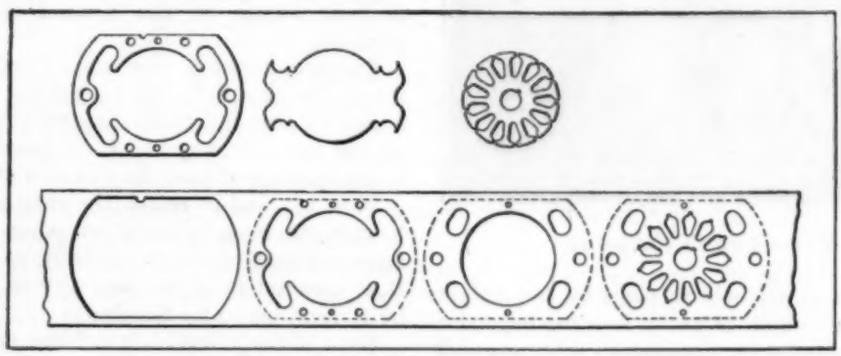


Fig. 1—The strip of stock and the punchings

The tools are carried in a four-pillar sub-press, of which Fig. 2 shows the upper member and the punches. As can be seen, each punch, or set of punches, has a separate holder located upon the side of the pillar-press by two dowels, for which hardened and ground steel bushings are provided in the plate. Fig. 3 shows the die, which is made in one piece.

A feature not often applied to pillar presses of this kind may be noted in Fig. 2, in the shape of felt rings attached to the lower ends of the bushings to surround the pillars and keep them lubricated as well as to wipe them clean and free from dust and particles of metal that are bound to adhere to them after the tools have been standing for any length of time. These rings are made of harness felt about ¼ in. thick and are attached to the bushings by small screws. Thin metal washers are used to prevent the heads of the screws from drawing into the felt.

The set-up in the press, Fig. 4, shows another set of tools of exactly the same type to produce the corresponding parts for a different motor. In this case, the longer dimension of the stator lamination lies crosswise of the stock, as may be seen in the strip issuing from the tools, but there is otherwise no difference in the layout.

The press is provided with a double roll feed—a pair of rolls at each end of the tools. The upper roll is in each case mounted in eccentric sleeve bearings which are so connected to the ram of the press as to lift both upper rolls from the stock at the instant the pilots enter the holes pierced by the previous stroke of the press, and thus the stock is left entirely free to be guided by the pilots. A crank lever, to be seen in the picture, enables the operator to lift the rolls at any time should it become necessary to adjust the stock under the tools.

The stackers, of which there are two on this press, are worthy of note because of their simplicity as well as their effectiveness. They are made of small rods, bent into a U-shape and fastened together to form a tubular conduit by means of bands of heavier metal to which the rods are attached by screws. The inner shape of the conduit is made to suit the shape of the punchings to be stacked.

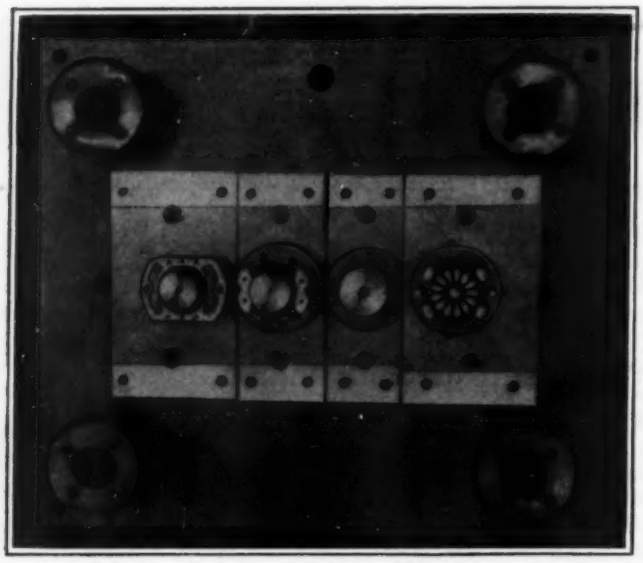


Fig. 2—The punches

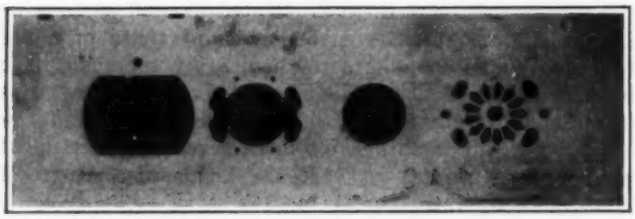


Fig. 3—The die

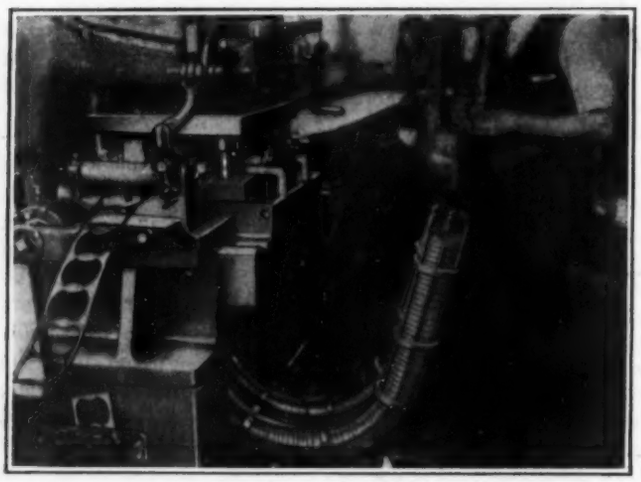


Fig. 4—The set-up in the press

The thin laminations are held in place by the weight of the rising column, which is never lowered beyond a point necessary to balance the descending column under the press. When a job is newly set up and the stackers are empty, they are filled by the simple expedient of stuffing a bunch of waste into them beyond the bend at the bottom. As the punchings begin to fall from the dies they quite naturally pile up on the obstruction, which is pushed ahead and finally out of the open end of the conduit by the weight of the accumulating punchings.

These tools were designed and made at the East Springfield plant of the Westinghouse Electric & Manufacturing Co., where they are in constant service and giving satisfactory results.

Seen and Heard

The purchasing agent

BY JOHN R. GODFREY

ALTHOUGH some purchasing agents have been guilty of most of the crimes for which they have been cussed by builders of machines and their salesmen, the job of purchasing a great variety of material keeps a man humping if he keeps things going straight in his department. The great sin of some purchasing systems is in letting the P. A. decide *what* to buy instead of confining his activities to the getting the material the production department wants.

There are two main parts to a P.A.'s job: Knowing where to get all the various materials needed, and also knowing where to buy them promptly and at the lowest market figure. These qualifications require knowledge born of experience, and a type of diplomacy that can keep him on friendly terms with his usual sources of supply, even when the orders must occasionally be placed elsewhere.

In a large concern, where orders run up into large quantities and values, the P. A. has a much easier time in keeping contact with his sources of supply than where the purchases are necessarily small. In the first case, salesmen call at regular intervals because an order runs into money. In the small plant, the P. A. is frequently called upon to exercise a high degree of persuasion to induce large sources of supply to bother to give him what his shop needs. This is particularly true when business is booming and mills and factories are full of orders. Then it frequently becomes quite a task to get what is needed.

These difficulties are rarely appreciated by the small-shop man who cannot understand why everyone isn't as glad of a small order as he is. He too frequently fails to allow sufficient time for getting the material, especially when the mills are busy. Nor does he appreciate that in many cases the sources of supply are very limited, owing to the limited demand for certain products.

The average-shop man cannot understand why there should be any difficulty in getting aluminum or steel sheets of just the thickness and quality he wants for a special job. Or why the P. A. cannot put his finger on a few springs of just the size and shape he needs.

Then too, sad to relate, the shop man frequently tries to pass the buck to the P. A. when he forgets to order some material until he actually needs it. And if the P.A. does not insist on requisitions to have as evidence, he is very apt to be the goat.

Even if the material is ordered promptly and a promised delivery date secured, the P. A. has to keep his weather eye peeled to see that nothing slips to prevent the material being received. He has to chase the various sources of supply to be sure that the delivery dates will be kept. He has to jog the memory of those who are good promisers and poor deliverers.

Last, but not least, he is open to the suspicion of playing favorites, for graft or otherwise, even when he is working for the best interest of his firm in refusing orders to some of the low bidders. As long as the P. A. sticks to the job of ordering and getting what the shop needs, he has my sympathy and admiration.

Gear Teeth in Action

By Earle Buckingham

Associate Professor of Engineering Standards and Measurements
Massachusetts Institute of Technology

Tentative formula based on recent tests accounts for combined effect of velocity, tooth errors, character of materials, tooth form, tooth loads and rotating masses

THE thought has been advanced that the actual tooth load in operation is the combination of two loads: first, the transmitted or useful load, and second, the additional or increment load caused by inaccurate tooth profiles, suddenly applied loads, and so on. If it were possible to produce theoretically perfect teeth, the impulse delivered to the driven gear would be smooth and continuous, fulfilling ideal conditions never attained in practice. With a pair of such gears made of inelastic material, variations in the driven velocity would be impossible, and the calculated static load could then be carried at any desired pitch-line speed, provided the gears were in perfect balance.

Tooth action, however, is made up of accelerations and decelerations due to errors in tooth form and spacing. At low speeds these errors have a relatively slight effect, but at high speeds they may develop increment loads many times greater than the applied or useful load. The gear teeth, therefore, must be sufficiently strong to carry this increment load in addition to the applied load.

In an article published in *Zeitschrift des Vereines Deutscher Ingenieure* in 1899, Oscar Lasche of Berlin discussed the probable effects of errors and the large increment loads that may result from them at high pitch-line velocities. He gave certain calculated values for these increment loads, but stated: "All such figures, however, depend upon assumptions, which influence the results to a large extent and do not permit the determination of results accurately." Considering rigid materials, he stated that the increment load caused by errors would be proportional to the square of the pitch-line velocities. However, he went on to say: "The more elastic the teeth are, the greater the errors that can be permitted. The differences in the velocities caused by the errors can be partially absorbed by the teeth themselves, without disturbing the velocities of the rotating masses so much, and without causing such high increment loads. The duration of the changes in velocity is spread over a longer period of time because of the springy action of the teeth, and consequently the acceleration of the masses is reduced and the increment load is cut down."

In a paper read before the British Institute of Mechanical Engineers in May, 1916, Daniel Adamson discussed the probable value of the increment loads along similar lines to those followed by Lasche. As a result of correspondence between Daniel Adamson, Wilfred Lewis, and Charles H. Logue, Mr. Lewis proposed in a paper read before the American Society of Mechanical Engineers in December, 1923, the construction of a testing machine that would enable these increment loads to be measured. A special research committee was organized by the Society, and arrangements were made to build the testing machine and to have a series of tests conducted at the Massachusetts Institute of Technology. The first series of tests with this machine were started in 1925 by John E. Nicholas, and the results are described in his thesis "The Influence of Errors and Elasticity on the Strength of Gear Teeth," submitted in 1926.

The machine* consists of a pair of test gears and pinions mounted in a swing frame centered in the axis of the pinion shaft and supported at a convenient distance upon weighing scales. By this means the torque can be measured when transmitting power received from a belt on a flywheel pulley mounted on the pinion shaft. The test gears are mounted on a telescopic sleeve and shaft, in which an initial torque can be introduced through a connecting nut of long pitch at the outer end of the telescope. The elastic reaction of the telescope maintains any desired average load on the gear teeth, which is augmented and reduced in action by the inaccuracies in the teeth and by the speed. Insulated ball bearings are used throughout, and electric circuits are established through telephone receivers which may be interrupted when either test gear fails to make contact with its pinion. When starting, and at slow speeds, there will be no interruption, but as the speed is increased there will come a time when the inaccuracies cause a momentary break in tooth contact. This will be announced by one of the telephone receivers and at that moment the corresponding speed, as indicated by the tachometer, is noted. Another initial load will show a different breaking speed, and in this way the loads and speeds can be correlated by experiment. For rigid teeth in rolling contact the initial load required to maintain contact is proportional to the speed squared, and the departure from this relation may be ascribed to elasticity and mass effects. For the accurate determination of the latter, special provision has been made in the application of a torsion balance to the pinion shaft direct. A light rod of tempered steel is attached to the pinion shaft and anchored at its outer end. A capillary pen mounted in a holder traversed by the oscillation of the pinion shaft moves over a paper ribbon traveling at a known rate of speed. This device was designed by H. H. Williams. It makes possible the accurate determination of the oscillating period for the pinion shaft alone, with, and without one or two of the flywheels, and with or without each of the test gears.

Provision has also been made to multiply and record the inaccuracies in the teeth on circular diagrams in

The ninth article. The tenth will appear in an early issue.

*For complete description see article by Wilfred Lewis on page 875, Vol. 59, of the *American Machinist*.

which they will appear as radial displacements, and a novel feature of this mechanism is that diagrams can be made and compared for the same teeth under very heavy loads as well as under the ordinary comparatively light loads which cannot show the effects of elastic deflection and compression.

The original purpose of these tests was to determine the effect of errors on the strength of gear teeth, but the results of the first tests showed that the elastic properties of the materials had such a pronounced influence that the whole subject of the effect of errors was too large to be completely investigated in a single series of tests. In the absence of more definite data, the results of these tests have been tentatively put in the form of the following equations for general use. Several of the inter-relations have been obtained by deduction, and it is planned to make further tests to prove or disprove the accuracy of these deductions. Before the final tentative equations are given, the effect of the several different factors as indicated by these tests will be discussed.

With any given pair of gears, the effect of the velocity on the load required to keep the gears in contact on the testing machine seems to vary roughly as the square root of the cube of the velocity in ft. per min. ($V^{\frac{3}{2}}$). At pitch-line speeds below about 1,000 ft. per min., the effect of the velocity is somewhat more than this, while at higher speeds the effect is less. The curves representing the results of these tests are established very closely by an equation of the following form:

$$L = \frac{CV^{\frac{3}{2}}}{V + 1{,}200} \qquad (1)$$

Where L = load on testing machine required to keep the teeth in contact, lb.

C = constant for any given pair of gears, depending upon the material, tooth form, pitch, accuracy, and other factors.

V = pitch-line velocity, ft. per min.

The load on the testing machine represents both the increment load and the applied load, as the conditions of test are such that these two loads are balanced. Thus when

W = applied or transmitted load, lb.

Ws = equivalent maximum static load on teeth, lb.

$Ws = W + L = 2L = 2W$ (for this balanced condition only).

With gears of the same tooth form, material, and pitch, the effect of errors as indicated by these tests seems to be almost directly proportional to the extent of the errors. Test gears with different types of errors, such as profile and spacing errors of different amounts, were used, but the effect of these errors seems to depend more upon their extent than upon their exact nature. It should also be noted that the noise of operation also seemed to be more or less proportional to the extent of the errors. Introducing the error factor, equation (1) becomes

$$L = \frac{C_1 e V^{\frac{3}{2}}}{V + 1{,}200} \qquad (2)$$

Where C_1 = constant for any given pair of gears depending upon material, tooth form and pitch

e = maximum error in tooth profile or spacing, in.

Gears of the same tooth form, pitch, and accuracy, but made of different materials gave very different results in these tests. Three combinations of materials were tested: hardened steel with hardened steel, cast iron with cast iron, and hardened steel with cast iron. Further experiments are desirable to obtain more complete data on this subject, and some tests have also been started on pinions made of non-metallic materials, but very little definite information has been collected. These preliminary tests, however, seem to indicate that the load on the testing machine varies almost directly as the moduli of elasticity of the materials used for the gears. When this factor is introduced, equation (2) becomes

$$L = \frac{C_2 e V^{\frac{3}{2}}}{\left(\frac{1}{E_1} + \frac{1}{E_2}\right)(V + 1{,}200)} \qquad (3)$$

Where C_2 = constant for any given pair of gears depending upon tooth form and pitch

E_1 and E_2 = moduli of elasticity of the respective materials used in the gears.

One pair of cast-iron gears had a much weaker tooth form than the other cast-iron gears tested. The results of the test of these weaker gears seem to indicate that the load on the testing machine varies almost directly as the stiffness of the tooth form. This conclusion is in agreement with the effects of the elasticity of the materials. Whether the difference in elasticity is due to the material or the tooth form, its effect on the load should be the same. The stiffness of the tooth form depends upon its shape, size, and face, and also the point on the tooth profile where the maximum load is applied. This last factor will always be a very uncertain one. With small errors, it might be safely assumed to be at the highest point on the tooth profile where a single tooth theoretically takes over the entire load. With larger errors, however, it may be at the tip of the tooth. In the absence of more definite data, and for the sake of simplicity, the relative stiffness of the tooth forms will be assumed to be measured by the Lewis factor "y." This assumption is open to question as the factor y is a measure of the maximum stress in the material and not the deflection. Eventually it may be necessary to establish a new tooth form factor for deflection, but available information is not sufficient to justify that course at present. Other more important factors must first be determined.

All of these tests were made on gears of 3 diametral pitch. A change in pitch would have two different effects. In the first place, a finer pitch gives a more flexible tooth. In this respect, the load on the testing machine should be directly proportional to the circular pitch. On the other hand, an error in profile of a given amount on the finer pitch would be equivalent to a larger error on a coarser-pitch tooth. In many ways, with a given error, a change in pitch would be equivalent to a change in velocity; that is, with two pairs of gears of different pitches but with the same extent of errors, the first pair having a circular pitch of one-half that of the second, the pitch effect alone on the first pair would be equivalent to doubling the velocity of the second. Thus the tooth form stiffness factor would be expressed by the following:

$$\text{Tooth form stiffness factor} = \frac{f y_1 y_2}{(y_1 + y_2)\sqrt{p}}$$

Table IV—Velocity Coefficients, Transmitted, Increment, and Total Loads for 10-D.P. Cast-Iron Gears—Marx

	Pitch-Line Velocity, Ft. per Min.										
	0	100	200	300	400	500	600	700	800	900	1,000
Velocity coefficient	1.000	0.795	0.730	0.675	0.635	0.595	0.565	0.540	0.520	0.500	0.484
Transmitted load, lb.	2,435	1,936	1,778	1,644	1,546	1,449	1,376	1,315	1,266	1,217.5	1,179
Increment load, lb.	0	499	657	791	889	986	1,059	1,120	1,169	1,217.5	1,256
Total load, lb.	2,435	2,435	2,435	2,435	2,435	2,435	2,435	2,435	2,435	2,435.0	2,435

	Pitch-Line Velocity, Ft. per Min.										
	1,100	1,200	1,300	1,400	1,500	1,600	1,700	1,800	1,900	2,000	
Velocity coefficient	0.470	0.455	0.445	0.435	0.430	0.420	0.415	0.410	0.405	0.400	
Transmitted load, lb.	1,144	1,108	1,084	1,059	1,047	1,023	1,011	998	986	974	
Increment load, lb.	1,291	1,327	1,351	1,376	1,388	1,412	1,424	1,437	1,449	1,461	
Total load, lb.	2,435	2,435	2,435	2,435	2,435	2,435	2,435	2,435	2,435	2,435	

Table V—Calculated Values of L from Marx Tests

	Pitch-Line Velocity, Ft. per Min.										
	0	100	200	300	400	500	600	700	800	900	1,000
Transmitted load, lb.	0	73	191	328	469	623	773	923	1,071	1,217.5	1,377
Increment load, lb.	0	73	191	328	469	623	773	923	1,071	1,217.5	1,377
Total load, lb.	0	146	382	656	938	1,246	1,546	1,846	2,142	2,435.0	2,754

	Pitch-Line Velocity, Ft. per Min.										
	1,100	1,200	1,300	1,400	1,500	1,600	1,700	1,800	1,900	2,000	
Transmitted load, lb.	1,502	1,640	1,775	1,908	2,038	2,164	2,288	2,410	2,531	2,646	
Increment load, lb.	1,502	1,640	1,775	1,908	2,038	2,164	2,288	2,410	2,531	2,646	
Total load, lb.	3,004	3,280	3,550	3,816	4,076	4,328	4,576	4,820	5,062	5,292	

Table VI—Transmitted and Increment Loads Calculated for Equivalent Static Load of 2435 Lb.

	Pitch-Line Velocity, Ft. per Min.										
	0	100	200	300	400	500	600	700	800	900	1,000
Transmitted load, lb.	2,435	2,048	1,842	1,690	1,575	1,476	1,396	1,328	1,268	1,217.5	1,167
Increment load, lb.	0	387	593	745	860	959	1,039	1,107	1,166	1,217.5	1,268
Total load, lb.	2,435	2,435	2,435	2,435	2,435	2,435	2,435	2,435	2,435	2,435	2,435
Velocity coefficient	1.000	0.841	0.756	0.694	0.646	0.606	0.573	0.545	0.521	0.500	0.479

	Pitch-Line Velocity, Ft. per Min.										
	1,100	1,200	1,300	1,400	1,500	1,600	1,700	1,800	1,900	2,000	
Transmitted load, lb.	1,131	1,095	1,062	1,032	1,005	980	956	935	914	896	
Increment load, lb.	1,304	1,340	1,373	1,403	1,430	1,455	1,479	1,500	1,521	1,539	
Total load, lb.	2,435	2,435	2,435	2,435	2,435	2,435	2,435	2,435	2,435	2,435	
Velocity coefficient	0.464	0.449	0.436	0.423	0.412	0.402	0.392	0.384	0.375	0.368	

Introducing this factor into equation (3) we have

$$L = \frac{C_3 e f y_1 y_2 V^{\frac{1}{2}}}{(y_1 + y_2)\sqrt{p}\left(\frac{1}{E_1} + \frac{1}{E_2}\right)(V + 1{,}200)} \qquad (4)$$

Where C_3 = constant depending upon relative masses
f = width of face of gear, in.
y_1 = Lewis tooth form factor for one gear
y_2 = Lewis tooth form factor for mating gear
p = circular pitch, in.

The determination of the effects of changes in the rotating masses requires further tests to obtain reliable data. The testing machine had two flywheels attached to the pinion shaft, and the loads required to hold the teeth in contact were practically the same with one or both flywheels attached. The reason why no difference was apparent with a change in mass was evidently due to the elasticity of the pinion shaft. Another flywheel was made and attached directly to the test pinions. In this case, a preliminary run showed that with this flywheel attached the loads required to hold the teeth in contact were about one hundred per cent greater than in the first case. This seems to indicate that when the rotating masses are mounted on the gear shafts at a reasonable distance from the gears or are connected by a flexible coupling, the masses can be ignored; but when they are connected rigidly to the gears, these masses must be considered, to what extent has not yet been definitely determined.

The results of the tests gave a constant C_3 of about 0.031, which is very close to $1/g$, where g = acceleration due to gravity, which can be taken as 32.2 ft. per

sec. per sec. Introducing this factor into equation (4), we have for our final tentative equation

$$L = \frac{efy_1y_2V^{\frac{1}{2}}}{(y_1 + y_2)g\sqrt{p}\left(\frac{1}{E_1} + \frac{1}{E_2}\right)(V + 1{,}200)} \qquad (5)$$

In the tests as run, the increment loads and the transmitted loads are equal, or very nearly so, and the weighed load represents both the increment load and the transmitted load. In these tests, the velocity factor is always 0.500. We know from Marx's tests that this velocity factor varies with different velocities when cast-iron gears are run to destruction. It has always been assumed that this velocity factor was constant for any given velocity regardless of the unit load on the gear teeth, but the results of these later tests show that although the increment load must vary with the applied or transmitted load, this increment load cannot be directly proportional to the transmitted load at all times.

We have from Marx's second paper the data given in Table IV for the velocity coefficients, transmitted loads, and increment loads for 10-D.P. cast-iron gears.

In this table, at a pitch-line velocity of 900 ft. per min., the velocity coefficient is 0.500. The curve representing the load on the Lewis testing machine under the balanced conditions of these tests should cross the curve of the Marx tests at this point. Substituting the breaking load of 1,217.5 lb. for L, at a velocity of 900 ft. per min., in equation (5), and solving this equation with the constants thus established for velocities from 100 to 2,000 ft. per min., we would obtain the values for L as shown in Table V.

A comparison of these two tables will show that the increment load varies much less than the transmitted load. For example, at a pitch-line velocity of 200 ft. per min., in one case we have a transmitted load of 1,778 lb. with an increment load of 657 lb., while in the second case we have a transmitted load of 191 lb. with an increment load of 191 lb. In this example, the transmitted load is increased 9.3 times, while the increment load increases only 3.4 times. In this case the increment load varies about as the square root of the transmitted load.

As another example, at a pitch-line velocity of 1,800 ft. per min., we have in the first case a transmitted load of 998 lb. with an increment load of 1,437 lb., while in the second case we have a transmitted load of 2,410 lb. with an increment load of 2,410 lb. In this example the transmitted load is 2.4 times larger in the second case while the increment load is about 1.6 times larger. This case also shows a variation in the increment load very nearly proportional to the square root of the transmitted load. From this comparison we will establish the relationship

$$Ws = W + \sqrt{WL} \qquad (6)$$

Where Ws = equivalent static tooth load, lb.

W = transmitted tooth load, lb.

L = load required to keep teeth in contact on testing machine, or load when transmitted and increment loads are equal, lb.

$\sqrt{WL}$ = increment load, lb.

Using this equation with the values of L given in Table V, we obtain the transmitted and increment loads shown in Table VI for an equivalent static load of 2,435 lb. at all velocities.

The values in this last table come as close to those in Table IV as could be expected from the results of two entirely different series of tests.

The probable order of errors in the gears tested by Marx was about 0.002 in., which is about the amount of error found in a pair of carefully milled gears of this pitch. These errors are largely profile errors and are usually more pronounced in gears with small tooth numbers than in those with larger tooth numbers. Solving equation (5) with a value of L equal to 1,217.5 lb. for a pitch-line velocity of 900 ft. per min., we get

$$\frac{efy_1y_2}{(y_1 + y_2)\sqrt{p}} = 0.000406$$

If this expression for the relationship of tooth form, pitch, face, and error is reasonably correct, it would mean that these gears had maximum errors of about 0.004 in., or about double the probable errors. This would indicate that the effect of the pitch should be proportional to its first power instead of its square root, or else that the chain and change-gear drive on the Marx machine introduced an uneven load condition equivalent in effect to an additional error of about 0.002 in. on these gears.

On the Franklin and Smith tests, we have already noted that a badly abraded change gear resulted in much lower loads than the other tests would lead us to expect. Further evidence of this possible effect of inaccurate change gears is found in Marx's first paper. With 20-tooth gears running at pitch-line speeds slightly under 200 ft. per min., and with 30-tooth gears running at slightly less than 300 ft. per min., a marked falling off in strength is noted, and this effect did not occur on later tests of other gears run at these same speeds. It is significant that a pair of 70-tooth change gears were used in the tests that gave low results, and that these 70-tooth change gears were not used in the later tests. Thus, it is possible that excessive errors in this particular pair of 70-tooth change gears were responsible for the low results.

Before drawing any final conclusions, however, we will examine the results of the tests made by Franklin and Smith. Three series of gears were used here; the first series with errors not greater than 0.001 in., the second with errors of about 0.002 in., and the third with errors of 0.006 in. The gears of the second series failed with a load of about half their static breaking strength at a pitch-line velocity of 1,000 ft. per min. The load at this speed was about 1,600 lb. Solving equation (5), we get

$$\frac{efy_1y_2}{(y_1 + y_2)\sqrt{p}} = 0.000478$$

Whence $e = 0.0044$ in.

The curve for the third series shows that these gears would fail with a load of about half their static strength at a pitch-line velocity of 600 ft. per min. The load at this speed would be about 1,600 lb. as before. Solving equation (5), we get

$$\frac{efy_1y_2}{(y_1 + y_2)\sqrt{p}} = 0.000841$$

Whence $e = 0.0078$ in.

Both of these two values for e show effective errors of operation about 0.002 in. greater than the actual errors in the gears; hence, it is fair to assume that the irregular action of the drive introduced additional loads on the gear teeth equivalent to an additional error of about 0.002 in. in the gears themselves.

The Responsibilities of Modern Industry

By Gerard Swope
President of the General Electric Co.

The four responsibilities of modern industry—Reduced selling prices increase production—Industry is primarily for service to the country rather than profit

"THE Responsibilities of Modern Industry" is so large a subject that it is quite intriguing and it is quite nice to play with, because one can say almost anything about it and still not cover the subject.

I want to treat this subject simply from its leading points, and I'm going to leave the rest of it to your imagination and for your suggestion to fill in. It is from four points of view that I want to look at the responsibilities of modern industry—first, from the standpoint of the public; second, from the standpoint of the employees; third, from the standpoint of the shareholders; and fourth, from the standpoint of the industry itself.

From the standpoint of the public, I re-echo Mr. David's words very gladly that my conception of industry is that it is not primarily for profit but for service. If you will look back at the developments of civilization, you will find that they have grown because one part of the community could do a certain job with less expenditure of energy than another and therefore industry was specialized and the community was glad to reward this service—that reward we call profit. We know of no better system today than the capitalistic system for rewarding individual effort or corporate effort, and it would be folly to change that system without very grave consideration of what those changes would involve.

But the responsibilities of industry to the public are not only for service but also for quality of material that is furnished. More important, it must not have a complacent attitude toward its work but a forward looking one. The test of the efficiency of any organization is going to be measured not only by its service and the quality of its products but by its continual and progressive reduction in the prices of its products to the public.

No Cut Throat Policy

That doesn't mean a cut-throat policy but it means the application of intelligence and of science to the problems before us; of better methods being introduced in industry, so that without reducing the earnings of labor we can still reduce the selling prices to the public.

Just see what that means, because it brings its own rewards! By reducing selling prices to the public, we are enabled to reach a very much larger circle of the community and therefore increase our volume of production, which has led to the great success in American industrial enterprise of mass production. It seems to me that it is largely the history of civilization. Modern industry is bringing to people a larger participation by an ever-increasing part of the community in the comforts and conveniences that modern industry has introduced into life.

Those are some of the responsibilities and obligations of industry to the public. And going with that, of course, are responsibilities of those who are spending their lives in the industry itself—the employees. At the beginning of the factory system it was perfectly natural that when power was introduced the proprietors should have thought that the only way to decrease costs was to decrease wages. We now recognize, I think, quite clearly, and especially in America, that nothing we can do will take the place of adequate earnings on the part of the working man and that the only way to safeguard adequate earnings is to bulwark our employees, our workmen, with power.

Workingman Has Greater Power

The thing that distinguishes modern industry in America from that in England or France or Italy, or any other country in the world, is the much greater power that we put back of the working man. But nothing (and let me make that quite clear) can take the place of adequate earnings. It isn't conditions of work, it isn't hours of work, it must be first and foremost adequate earnings for the working man. And that doesn't mean high costs, because high earnings on the part of the working men are not inconsistent with the low costs of production.

The second thing, it seems to me, that we have to safeguard with our working men, if we want to have them give to their work the best that is in them, is to remove from them some of the worries that have been attendant upon working men from time immemorial. The first, of course, is the thing that is with all of us at all times—the uncertainty of life. It is curious that even among educated people life insurance must be sold. In other words, that people must be educated to the need of it. How much more is it true with people who have never given it much thought—the working man!

It seems to me that modern industry is recognizing the need for that insurance, not as a philanthropic enterprise, and not as something that they are giving to the working man. The best thought is that the working men themselves, in accord with their own self-respect, should contribute toward the cost. First it is necessary to educate them and then to provide an easy means of insuring their lives so that the tremendous responsibility and doubt of how their families and their children

An address delivered at the annual dinner of the Associated Business Papers, Inc., at the Hotel Astor, New York. Nov. 10, 1926.

will be cared for when they are gone is removed. Take away care from a man's mind and he will devote himself whole-heartedly to the work ahead, and do a much better job.

The third problem before us is to provide for the working man adequate housing, not as a gift, not having the manufacturer become the landlord, but by putting the man in the position and educating him to the responsibilities and opportunities of becoming his own home owner.

It is quite remarkable, and I suppose that it is true with all of us. I think that is one of the remarkable things in the revolution in Russia—what a tremendous appeal it has made to the peasants to own the land! They will accept almost any system of government that guarantees their continuance in the possession of the land. That is something innate in man, no matter what his station in life is and if we can provide it on a good basis for the working man, we have made a great contribution to his satisfaction and to his contentment.

The fourth responsibilitiy of modern industry is to offer the means of thrift and investment. It isn't so much that the man should get rich quickly because there are so many attractive things that are offered to him that sometimes don't come through, but he should be able to secure some means where the principal is assured and the income is fair and uniform and certain, so that if he lays by something from time to time, at the end of a certain period his principal will be intact and he can enjoy the income during the years to come.

The next problem of American industry and of industry in general, particularly in Europe today, is the question of unemployment. I don't know of any grievous problem confronting modern industry today, which we have more signally failed to solve than the question of unemployment. The idea that men who are able, who are honest, who are willing to work should find it difficult, even when the community needs their service, to perform that service is one of the most tragic and one of the severest indictments of our modern civilization. We have done but little in its solution.

Concerted Effort of Industry Required

There have been unemployment conferences, and many suggestions have been made, but it takes really a concerted effort on the part of industry as a whole and on the part of the community as a whole to solve this very serious problem. Of course, if these other problems had been adequately solved—of compensation, of life insurance, of housing and of thrift in investment, then the problems of unemployment, and last of all pensions, become almost secondary. Especially in America and England, if you provide those essentials, these men will be able to take care of themselves.

I think there is a good deal in that, but it means, of course, that the basis must be soundly laid. Nothing can take the place of an adequate conception of the responsibilities of industry to the employees who are giving the best that they have—their lives—to their work, and no stable foundation can be laid that doesn't adequately recognize that principle.

The third responsibility of industry is to the shareholders. What shareholders want is a fair, regular, and uniform return, and what management wants is such a return to shareholders that when they need new capital, for the extension of their business or new tools of production, it will be forthcoming. Of course, incident to that, if you are going to expect the confidence of your shareholders, you must tell them of the activities of the company, and give adequate publicity in regard to its earnings, its orders and its shipments.

It seems to me that those who put their lives into the business and those who put their earnings into the business are entitled to at least that consideration, and no business really can be successful over a long period that doesn't recognize those elements.

The fourth responsibility of modern industry that I spoke of before, and one possibly that just recently I have given more attention to than others, is the responsibility of the industry to itself. I think maybe in the last 20 years we have given more attention to the question of what organization and association of different companies in America can mean for each other. We have large and small companies associated together and they meet on a basis of equal opportunity.

Success Essential to Growth

I was addressing a gathering the other evening on this subject and I said, "It isn't necessary to be big to be successful, but it is absolutely essential to be successful to be big. You can't grow without that." Certain advantages favor the small companies—mobility, flexibility and specialization; and large companies have opportunities and also their responsibilities—of research, of seeking for better methods and new truths and new ways of doing things, and, of course, of educational work. It is a tremendous work that is still to be done, even with as enlightened a public as we have in America. It is remarkable how long it takes to get a message across. Each one of you in your own experience has seen that—how often you have to preach the same word before it reaches the consciousness of certain individuals. That is true in industry and it seems to me that industry has more to fear from the unsuccessful than from the successful, from wrong policies, from ignorance of method, and from ignorance of the elements of cost.

There is a tremendous job to be done, and it seems to me that small companies in many ways need organizations of this character more than large ones because large companies have a national organization, have statistics in regard to industry, know facts, and know conditions upon which to base the work that they are planning. No intelligent plan can be made without a proper conception of the program and also the facts that underlie that program.

One of the greatest things that associations of this kind can do is the dissemination of facts to all members of the industry. Of course in this the public press, and especially the technical and business press, has a tremendous function. The interpretation of the ethics and ideals of business and of industry to the public can have no better mouthpiece, can have no better spokesman than the technical and business press.

If the ideals and ethics of the business press which you have interpreted tonight are really carried home it seems to me that your organization can do a tremendous amount of good in leading modern industry along the paths it should go of helpful, instructive criticism, right understanding, and an interpretation of the philosophy and trend of modern industry, and if we have that leading light it seems to me that our modern industry is going to serve the public better than it ever has before.

Automotive Production

How Production Methods Vary in Shops Building "Light Sixes"

By Fred H. Colvin
Editor, *American Machinist*

Some of the assembling operations of the Overland "Six" engine—Securing alignment of bearings and other parts to insure satisfactory running

MUCH of the satisfaction to be derived from any machine depends on the care with which it is assembled. For this reason the methods used in assembling automobile engines are of special interest to both the user and to the engineer engaged in similar work, or work that may be comparable in greater or less degree. While it is, of course, not possible to show all the details of the assembly line at the Willys-Overland plant in Toledo, enough will be illustrated to give a good idea of the work as it progresses.

Several special fixtures or devices are used, such as the fixture or machine in Fig. 1 in which the camshaft bushings are pressed into the cylinder block. The valve-guide bushings have already been forced into place and the main bearing caps are tightened while the case is on the machine. The block is positioned by the plug *A*, and another one at the opposite end.

The block then slides along and the oil holes from the main bearings to the camshaft bearings are drilled as in Fig. 2, so that the oil from the pump will have direct access to the camshaft as well. The air drill is counterweighed so as to be easy to handle. This view shows the camshaft bushings in place.

The next step is the line reaming of the camshaft bearings as in Fig. 3. The block is held rigidly in the fixture, positioned both by dowels in the flange holes and by the plugs in the end main bearings. The fixture is mounted on a Rockford horizontal machine and the reamer bar is driven through a floating connection.

The hole for the oil-pump connection is bored in the fixture in Fig. 4. Here again the block is positioned by dowels and by plugs in the main bearing holes.

* The thirteenth article. The fourteenth will appear in an early issue.

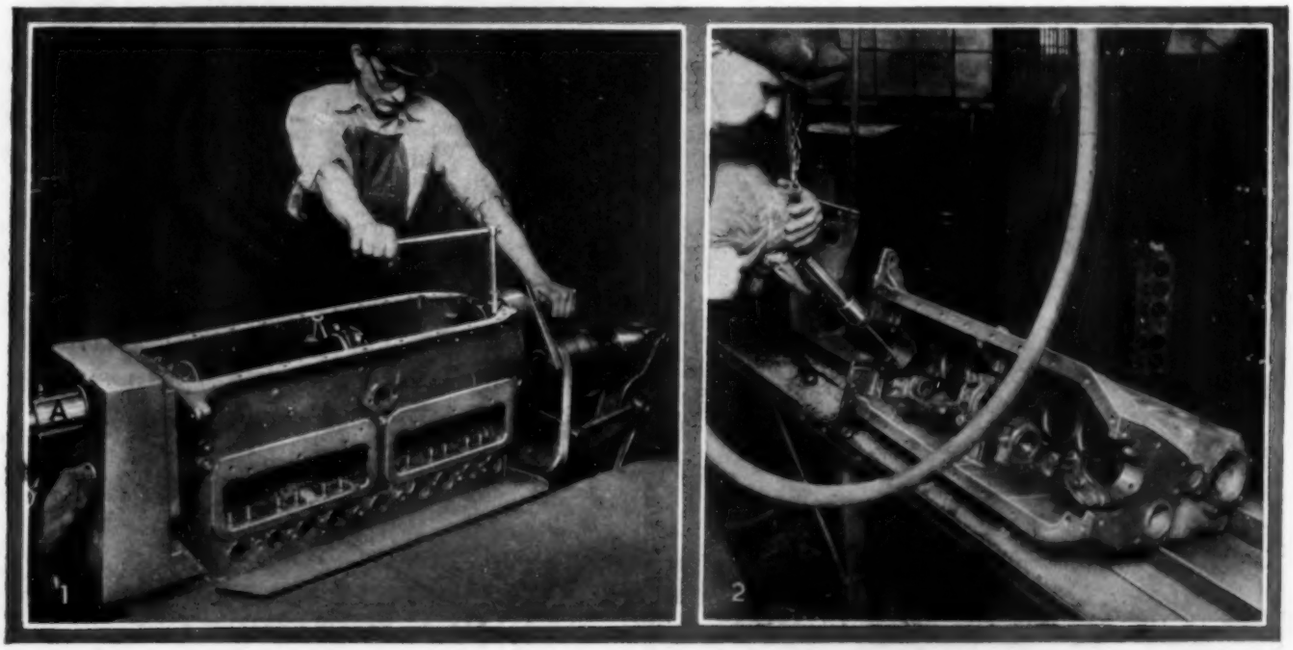


Fig. 1—Pressing in camshaft bushings. Fig. 2—Drilling oil passages

Automotive Production

The boring bar and reamer are both guided in the substantial support *A*, cast on the side of the fixture, insuring the necessary accuracy to have the pump gear mesh with the gear on the camshaft.

To secure the proper location of the engine support on the end of the block, the holes are reamed with the aid of a plate jig as in Fig. 5. The plate is located by the main- and camshaft-bearings so as to position it correctly for reaming. After reaming, each hole is plug tested and the tapped holes are retapped as in Fig. 6, to insure easy assembly when the supporting arms are bolted on the block. The

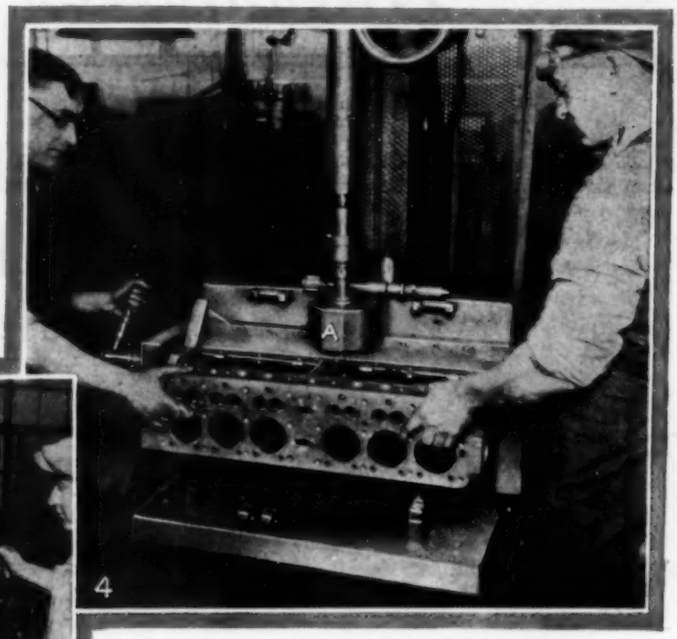


Fig. 4—Boring for oil pump

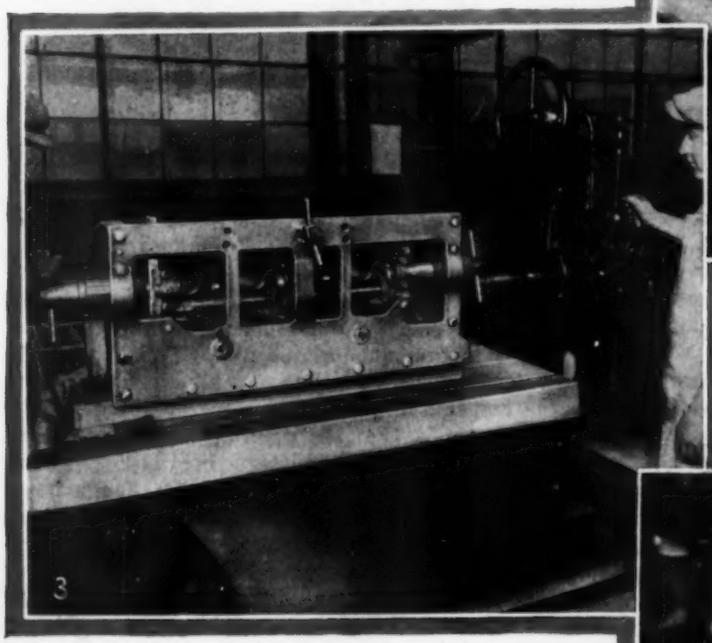


Fig. 3—Line reaming camshaft bearing

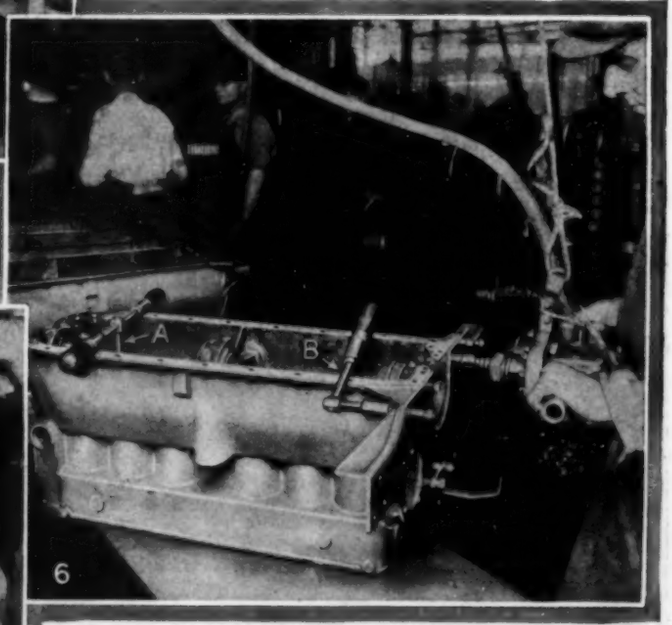


Fig. 6—Putting on support arms

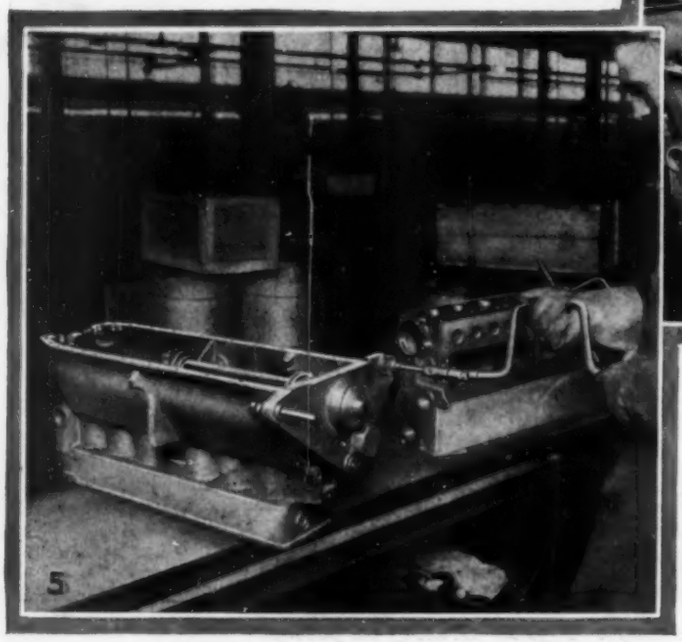


Fig. 5—Reaming support holes

Automotive Production

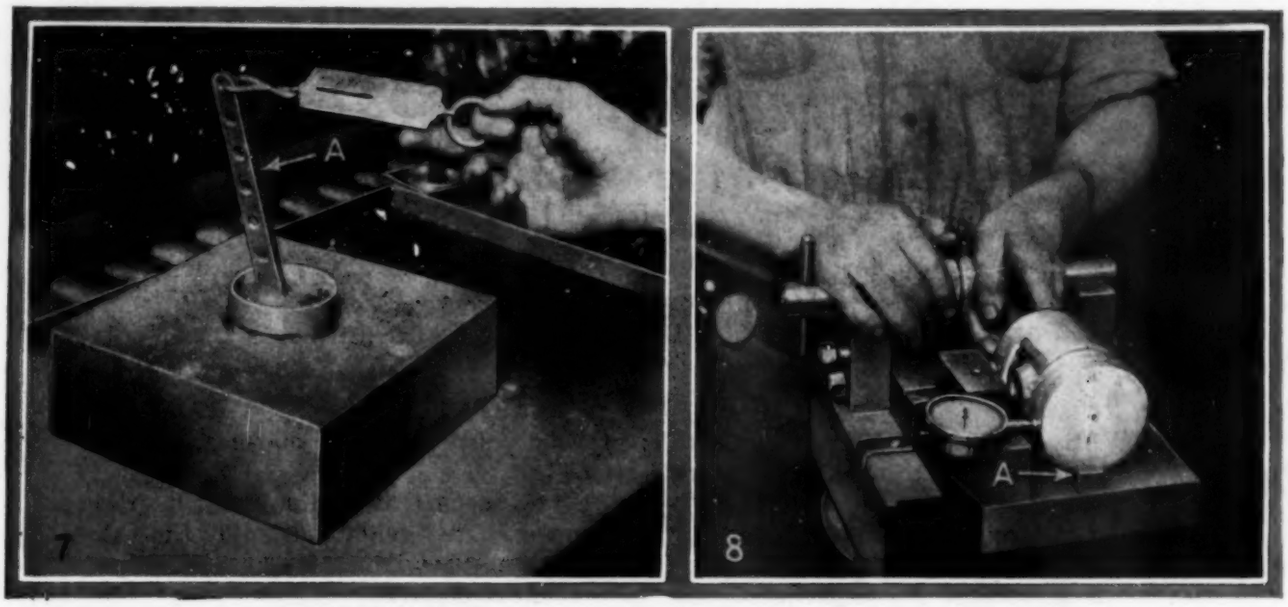


Fig. 7—Weighing piston pin fits. *Fig. 8—Checking piston alignment*

nuts are driven by an air motor and given a final "set" with the hand wrench *A*. The wrench B is for tightening the through bolt used in this position. The practice of bolting the engine supports on the end instead of casting them as part of the block, is growing, and has proved advantageous in every way.

The valve seats are all hand reamed and each seat is tested with a very thin feeler under the valve. Connecting rods are selected to suit the crankpins on which they are to run. While the tolerances are close, the method is one very generally accepted for securing a uniform oil film between the bearing surfaces.

Piston pins are also selected, each pin being "weighed" in the piston as in Fig. 7. The pin is inserted in the piston and the wrench or lever *A* is clamped to it. Then the pressure required to turn the pin in the piston is weighed as shown, the required pull being about 4 lb. This test insures uniformity in all pin fits in the piston.

The final piston and connecting rod assembly is tested by the fixture in Fig. 8. The rod bearing is mounted on a master pin representing one of the crankpins, and the piston is laid in the gage as shown, on the center support *A*. Then the piston is reversed and the two readings of the dial indicator compared.

Refitting Motor Truck Bearings

By A. H. Leiport

Hand scraping is the earliest method used in the repair of motor truck bearings, and requires only simple hand tools plus plenty of time and a man who knows how. After the bearing shells are seated in the crankcase, blue is applied to the journals of the crankshaft and an attempt is made to line up the upper bearing halves while trying to keep the front bearing at a height that will not move the timing gears off their pitch lines.

This scraping requires many hours of exacting work. Then the lower halves are fitted to the caps and also scraped in. The finished bearing has the appearance of having a good bearing surface, but it really consists of a number of scooped out depressions and peaks of metal on which the journals ride until the high spots are flattened out by use.

Bearings well fitted by the hand scraping method are always tight at first, and must be run in very carefully. It is often necessary to run the engine on a belt for a number of hours, followed by a run under its own power with light load and excess lubrication.

This practice naturally led to line reamers having the same purpose but designed to keep the bearings in line at the same time. If the line reamer is designed especially for an engine, it will give good results, but not as good as are obtained with a boring fixture. Considerable hand scraping is required, therefore, to correct misalignment after using a line reamer.

Burning-in bearings appears to be a rather brutal and crude method. Yet the results obtained in a light and very popular car are not bad. Here the engines are turned by outside power while the bearing caps are gradually tightened. The frictional heat generated in the bearing causes the bearing metal to flow and conform in shape and size to the crankshaft journal. A stream of lubricant is directed on the bearing during the process.

The main bearing boring fixture used in the Mack service stations consists of a rigid bar extending through all of the bearings, and having a bracket assembly to hold it in an exact position. Adjustable fly cutters are mounted in the bar, which is fed slowly through the bearings. In the first place the cylinder blocks are mounted in place on the crankcase, and all bolts and studs are put under the same tension as when the engine is assembled ready to run. Alignment is indispensable if the job is to give full satisfaction.

Extracted from a paper presented at the Transportation and Service Meeting of the S.A.E., in Boston, Nov. 16-18, 1926.

THE · FOREMAN'S · ROUND · TABLE

Cutting Down Spoiled Work

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

ED WAS a bit glum as he sat down with Al on the train after a day's work was over.

"What's the trouble, Ed?" asked Al.

"Trouble enough, Al. Williams razzed me this morning because my department was making more scrap than usual. Read me a lecture on the waste and loss due to spoiled work. Seems to think we can turn out work without spoiling a piece once in a while."

"Guess that's a bit exaggerated, Ed. Williams isn't often unreasonable. If your scrap is more than usual, it's time to try and find out the reason."

"Looks to me, Al, as though the inspectors had it in for my gang. Can't seem to suit 'em, anyhow. Work seems all right by our gages but they reject it just the same."

"If that's the case, Ed, I'd have the gages checked up the first thing tomorrow morning. Your gages may be worn beyond the limits. I'd be dead sure of that first."

"Suppose it isn't gages, Al—then what?"

"Then I'd hunt for worn tools or machines, Ed. But beyond that, I'd stage a little exhibition for the boys to think about."

"I don't get you, Al. I'm in no mood to entertain my gang with moving pictures or vaudeville. What do you mean—exhibition?"

"Not a movie, Ed. I didn't say entertain the gang. They might not enjoy the exhibition at all—but I'd make it just the same."

"Home come, Al?"

"Well, Ed, I'd save all the spoiled work and put it on a bench where every man can see it. Make a sign if you want and say 'WORK SPOILED IN ONE DAY.'

"I'd go further than that, Ed. I'd find out from the cost department how much each piece had cost up to the time it was spoiled. Then I'd put a sign on each piece or each pile and say, 'THIS MEANS A LOSS OF $25.50,' or whatever it is. There's nothing like dollars and cents to make a man realize what it costs to spoil work."

"I'll do that, Al. That's a darn good hunch. Believe I'll go further and put each man's name on the work. That ought to hit 'em between the eyes—eh, Al?"

"Not so fast, Ed. Right there you introduce complications. What good would that do? Put yourself in the operator's place. Better think over both sides of that question before making your decision."

Was Al likely to be right about the gages being worn? Or Ed that the inspectors were after his scalp? How is Al's plan to impress the amount of spoiled work on the men? Was Ed wise in proposing to label the work with the men's names?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Just What Is Discipline?

DISCIPLINE is the outcome of training and it is by discipline that we learn to control and to correct the animal instincts of ferocity that are born in us. Civilization and progress are the results of discipline. Many different methods of discipline are used in our factories today as a result of the complexity of business and the individuality of the executives. Everyone agrees, however, that it is a necessity to have a code of rules and regulations to be observed by employees.

The best precaution to prevent fooling during the noon time recess is to close up shop during this time and to open up again about ten minutes before starting time. From experience I find that this prevents interference from boys and sometimes from men whose fingers seem to wander on to machines that are set up and, incidentally, to spoil work. It is up to the foreman to stop any fooling at other times and to bring to the notice of the violator any infringement of rules.

Foremen should not get near-sighted to avoid seeing things that they would rather not know. It is the duty of foremen to see any breaches of discipline and to teach their men to observe the rules as well as to see that they understand the importance of regulations that have been adopted by the management.

Rules regarding smoking are a necessity in many branches of industry, especially in the pattern shop, wood mill and in shops where any inflammable material is being used. Smoking in shops of this character should be strictly forbidden and the rules should apply to visitors as well as to employees.—C. L. HENRY, *Foreman, England.*

Teamwork in the Shop

WITHOUT co-operation; i.e., co-operation both between the foreman and his men and between one foreman and the next, no company can reach its highest degree of production.

The instincts of self-preservation and self-pride are, of course, natural with all of us and Ed, instead of looking ahead to see that the finished machine is what counts, is a victim of this self-pride. He does not realize that his parts alone will not make a finished machine. The company cannot profit by an overstock of one part and a lack of other parts.

It is not likely that a foreman will progress so far in co-operation that he will allow his own job to slide to help another foreman. That is not human nature. If this were the case it would seem that the foreman was fundamentally more interested in his fellow foreman's job than in his own. The sooner that Ed can appreciate the meaning of co-operation, however, the more valuable he will be to his company.—B. C. CARSTENSEN, *Junior Engineer.*

Just What Is Discipline?

WHEN you can get a man to do just what you want him to do and to do it right, it is a case of perfect discipline. But there is a diversity of opinion as to just how this perfect discipline is to be obtained. One place where discipline is necessary is in the case of preventing accidents caused by the irresponsible fooling of some men.

The best way to obtain discipline in this case, in my opinion, is to hold up to the men their future career. If the employees are sensible, they will listen to what is said. Those that are foolish will ridicule you to the rest. Such men I get rid of as soon as the opportunity arrives. There is more work to be obtained and more good to be done by leading the men rather than by driving.

To prevent accidents caused by fooling it is necessary to educate the men to know better, to show them what such fooling has resulted in, in the past. If a man cannot be made to see his actions in the light of what has happened from similar actions in the past, he becomes a danger to others in the department and it is better to discharge him.

Rigid discipline in the work shop cannot be enforced as it is in the army, nor is such discipline desired to produce the greatest amount of work done. The best results will be obtained when the foreman has confidence in his men and the men have confidence that they will get a square deal from the foreman.

You cannot apply rules to customers when they are visiting, but if a party of visitors wishes to be permitted to see the plant they should be requested to observe such rules as those for not smoking. Smoking should not be allowed in the shop except at specified times such as during the lunch hour.—H. MAPLETHORPE, *England.*

Getting Information from Catalogs

HOW can Ed question the worth of a catalog when there are millions spent yearly in the compilation, printing and distribution of them? I can cite one instance where my concern wanted a certain kind of job and in order to get it out I had to have a particular type

THE · NEXT · TOPIC

More About Discipline

QUESTIONS

Will temporary demotion to unskilled jobs as a punishment cure or kill?

Can it be done without making inroads on the company payroll?

If not, is the treatment worth the cost?

THE · FOREMAN'S · ROUND · TABLE

of machine. To save my life I couldn't think of the maker of that tool, so I hunted through the pages of the advertising section of the *American Machinist* until I found a picture of it.

The next move was to get more information from the people who built it. A catalog came post haste and I got the information that I needed and soon along came the tool. There was no better way than that. That wasn't all that I found in that little catalog. I found the names of some people who were using that machine. I went to one concern that was listed and saw one of the machines in operation. It wasn't being used for identically the kind of work for which I was going to use the machine but at least I saw enough so that I didn't start in on the machine like a Feejee Islander monkeying around an electric vacuum cleaner.

But while we are in the age of standardization why not do a little of it on catalogs? I mean in regard to size. At the present time they fit in a cabinet about as gracefully as brush wood in a bushel basket.—STORRS T. RICHMOND, *Master Mechanic.*

Just What Is Discipline?

THE necessity of discipline in the school, army or navy is unquestioned but the importance of maintaining it in the shop is not so generally recognized. I served my apprenticeship and worked for several years in shops in Germany. While the severe discipline there would never be tolerated in this country where the people claim so large a degree of personal liberty, still the enforcement of strict discipline in our shops would increase the efficiency of the workers themselves.

It does not follow that the man or boy should doff his hat or servilely bow every time the foreman passes his machine, but the foreman should command the wholesome respect of every man working under him. A superintendent should never scold a foreman in the presence of his men as it would tend to lessen their respect and would undermine the discipline. Likewise a superintendent should never give a job directly to a man without notifying the foreman since this will put the man in the position of serving two masters and is not conducive to good discipline.

Discipline includes the punishment of men for offenses, the correction of errors and the enforcement of all the ordinances adopted for the safety of the men. If a man is to be reprimanded for a mistake, it should be done in such a way that he will not incur the ridicule of his fellow workers. If the fire commissioner's ordinance of "No Smoking" is in effect, the rule should be stringently enforced. This should also be observed by the employers and visitors. It cannot be expected that the men will obey a law which is broken in their presence by their superiors.

It is not to be thought that discipline, no matter how strict or severe, can eliminate altogether the horse-play and practical jokes that are so prevalent in the shops but summary punishment should be meted out to those offenders whose pranks endanger the lives and limbs of their co-workers, or are detrimental to the efficiency of the shop.

Discipline should not only be an instrument of punishment; it should be the subjection of the men to the control of their superiors in the interests of efficiency and the observance of those regulations which protect the lives of the men themselves.—G. KIRCHEIS, *Foreman.*

Getting Information from Catalogs

ED IS overlooking a lot of valuable information which can be had for the asking, when he slights the catalog. If Ed would spend a little time now and then looking over some of these catalogs and give them the same attention which he gives to the baseball scores and batting averages, he would be surprised at the amount of useful information that they contain.

Al is right in saying that he gets direct help from such booklets. They often show photographs of set-ups and methods of tooling which, with their tables of speeds and feeds, often set a man straight as to what he ought to be getting from his machines of the same type.

Ed says that it is actual production and not paper talk that counts but he seems to forget that what is now actual production was paper talk a few years back.—THOMAS M. GARRY, *Foreman.*

Teamwork in the Shop

ALTHOUGH a shop foreman's chief duty is to see that quality and quantity are kept up to the requirements at as small an expenditure as possible, he should not lose sight of the fact that the only way the concern for which he works can do a profitable business is for all departments to work in unison.

While the foreman is not held directly responsible for work outside of his department, he is rightly chargeable for any hindrance that his department may be to another department. It is no worse for a department to be short in its quota of parts than it is for another department to be far in advance of its schedule when it can be of assistance in bringing another department back to quota.

While the details of his own department are the first responsibility of the foreman, he cannot escape and must not neglect to think of the organization as a whole, and show a willingness to help out whenever and wherever he can do so. I know of no better way to prove that such a feeling of co-operation exists than to help out a fellow foreman when one is in trouble, not only to the extent of evening up, but by going a bit farther for good measure. I have never known of a foreman or a department suffering, in the long run from such service.

Surely the foreman who works and plans along such lines can have every reason to expect the help that he may need in times of trouble and can approach his general foreman or superintendent for aid without em-

THE · FOREMAN'S · ROUND · TABLE

barrassment. I think that the foreman should present his case to the general foreman or superintendent rather than to seek aid from a fellow foreman directly. This method uses the organization and tends to maintain good feeling.—JOHN MARK MAY.

Getting Information from Catalogs

BOOKS are certainly fine things, but times do change so. A machine tool or method regarded as the last word in efficiency today may become a back number next year. Booklets offer many valuable suggestions and there is some satisfaction in leisurely looking them over without the moral suasion or influence of a company representative at your elbow.

While the pamphlet, circular and booklet are indispensable, it is the technical magazine with its profuse advertising which opens the field and paves the way for the manufacturer. The advertising pages therefore should be of the highest quality and should contain as much information and be as efficiently prepared as possible.—EMIL E. ERBE.

Just What Is Discipline?

THE question is, "What did the Old Man mean about discipline?" It is up to him to maintain discipline and he probably meant every word that he said but be 100 per cent perfect and he may have exaggerated the case considerably. Now discipline means to govern, instruct and chastise. The Old Man cannot be all over the place at one and the same time, so he tells his foreman what is expected and when the shop rules are badly bent and production is not what it should be, he is pretty apt to let go with both barrels.

If the men must play in the shop during the noon hour a place should be provided for it. Horse-play around machinery cannot be permitted. It is too dangerous. Then again there is that milling machine, for instance, all set up and going well. One of the fellows hits the handwheel and disturbs the set-up. The operator goes back to the job, starts the machine and probably runs several pieces of work through before discovering the disarrangement. If you want to find tote boxes and trucks scattered all around the shop, just let the men have their horse-play.

It is necessary to be diplomatic, however, in the treatment of the men and in the correction of breaches of discipline. Insist on the strict observance of shop rules but make allowance for the human side of men. Push those who need pushing or else get rid of them.

Unless the job is exceptionally hard and the hours long, no smoking should be permitted. In the case where it is the firm which issues the order, and where there is no fire hazard, an exception should be made to allow smoking during the noon hour. Where insurance laws make the rule, of course, it cannot be permitted at all. The ban on smoking should apply to visitors as well as to employees.—W. R. HENION, *Superintendent.*

Assigning Work to Machines

AL'S suggestion of having a planning board with an envelope containing the necessary blueprints and instructions covers only a part of a good production system. His suggestions together with the proper routing and records of work done make a system suitable for the majority of shops. When a shop is too small to employ a clerk for the paper work, it is at times merely an added clerical job for the foreman to handle. In such cases a good memory is the best planning board.

Cards or paper tickets usually are the most convenient to handle. Envelopes are sometimes used to hold the blueprint but this necessitates the folding of the blueprint to a small size which makes the prints hard to handle when opened. Blueprints can be filed at the planning board and passed out with the work cards.

It is very difficult for the men in the planning department to properly designate the best machines for the jobs. The foreman is constantly in touch with his men and equipment and should be able to pick the best place for the job. By arranging to have the foreman see the jobs between the routing time and when they are put on the planning board, he will know what is coming. He can do the assigning of the machines at this time and also make notes of tools he will require. This arrangement makes the foreman part of the system, which is highly desirable.

Al's suggestions do not mention the arranging of jobs with reference to the needs of the assembly department. To merely assign work as it comes along to the machine with little ahead, does not insure delivery on promised dates. Some sort of a schedule with dates on which delivery is required should also be used. The dates must appear on the work cards so that the foreman will know when the parts are expected. A partial or poor system is usually worse than no system since it leads only to friction between the foreman and the clerk.—LAWRENCE F. SWENSON, *Standards Engineer.*

Just What Is Discipline?

THE rules or policies involving discipline should be sold to the foreman in such a way that he will be in accord with them. No rules should be adopted that are not going to be willingly complied with by the one who issues them, whether he be superintendent or foreman.

Infractions of rules cannot be winked at, since this is flirting with bad morale in the shop. It is the little infractions which are not nipped in the bud that bloom into beautiful bouquets of trouble for the one who fails to eliminate them. Fooling or horse-play cannot be tolerated where hazardous work is being performed.

Most all workmen will comply with just rules if sold to them through personal contact, rather than by merely posting them on a shop bulletin board.—B. FRANK, *General Foreman.*

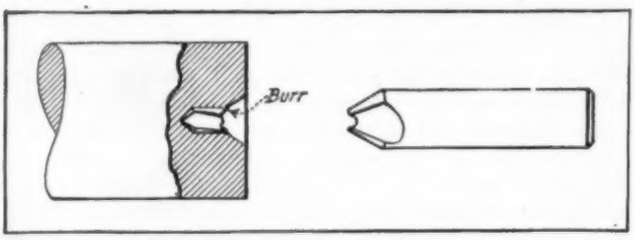
Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Removing a Broken Center Drill

BY E. PALMQUIST

Anyone familiar with machine-shop work knows how much time may be spent in removing a broken combination center drill from a piece of work. Experience has shown that the broken end of the drill is held in the



Removing a broken center drill

work by a burr over the mouth of the hole, caused by the spinning action of the countersink after the drill has broken, and before the operator has withdrawn it from contact with the work.

The burr can easily be removed by grinding a shallow notch in the existing lips of the countersink, making it into a two-lipped hollow mill, as shown in the sketch, and applying it to the work. After the burr has thus been removed, a sharp blow on the end of the rod, at one side of the center, will bring out the broken drill.

Care in Babbitting Bearings

BY M. R. ARMSTRONG

The importance of good bearings is often overlooked by practical shop men. A study of the troubles that may be caused directly or indirectly by poor bearings, emphasizes the necessity of having complete control of babbitting conditions, so that all bearings will be uniformly good.

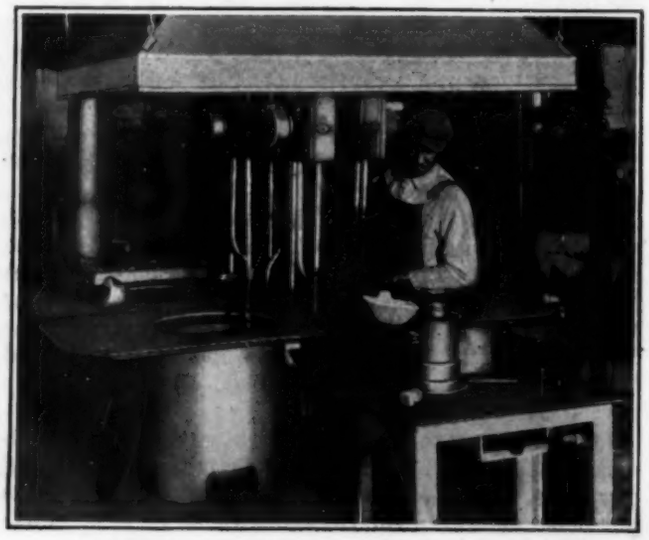
While the general procedure in babbitting is well known, the following details are very important and should be watched carefully:

1—Properly cleaning and tinning bronze shells.
2—Preheating of mandrels and shells before babbitting.
3—Correct temperature of the metal.
4—The handling and pouring of babbitt in the bearing shell.
5—Reliability of source of supply of babbitt metal.

One cause of trouble in babbitt bearings is the loosening of the babbitt metal in the shell. This trouble can be prevented by a thorough cleaning of the shell before the metal is poured, and by using the proper tinning method. The tinning alloy most frequently used is half-and-half solder. It should be heated to a temperature between 770 and 824 deg. F. Shells, especially those having anchor holes, should be thoroughly cleaned, and all scale and rust removed.

The mandrel and the shell should both be preheated in order to prevent the chilling of the babbitt in pouring. Preheating not only prevents the chilling of the metal, but helps to prevent blowholes, and also permits the shell and the babbitt to cool and shrink together, thus avoiding a prevalent cause of bearing trouble.

Probably the most important detail to watch in pouring babbitt is the temperature of the metal being poured. If the metal is too cold, it will not run freely into the shell, and will be likely to have cold cracks. If it is too hot, it will be hard, and will not stand up under the severe service and shock to which the ordinary bearing is frequently subjected. It is very important that the temperature while pouring, be kept between 860 and 900 deg. F. At no time should the



Electrically-heated, automatically-controlled melting pots

metal be permitted to become heated above 914 deg. F. If this temperature is exceeded, the babbitt is liable to be greatly damaged, and the bearing invariably gives inferior service. The metal should be poured from the ladle in a steady stream directly down and along the mandrel, to prevent air from pocketing and forming blowholes.

For bearings where the service is exceptionally

severe, such as in high-speed work, the quality of the babbitt metal used is of great importance. In order to be absolutely sure of the proper alloy mixture being used, nothing but high-grade babbitts of known compositions should be allowed in the pots. For low-speed, heavy bearings, it is often a common practice to re-use the metal that has been melted out of shells. Such metal, however, should not be used in rebabbitting the more important bearings.

The above outline of the important details for obtaining high-grade bearings, may seem difficult. It has been found, however, that by the use of electrically heated pots having automatic control, that these results can be obtained uniformly and consistently with ordinary care. The main reason why this is so, is that nothing is left to the guesswork of the operator, and he can always be certain of the conditions under which he is pouring the bearings.

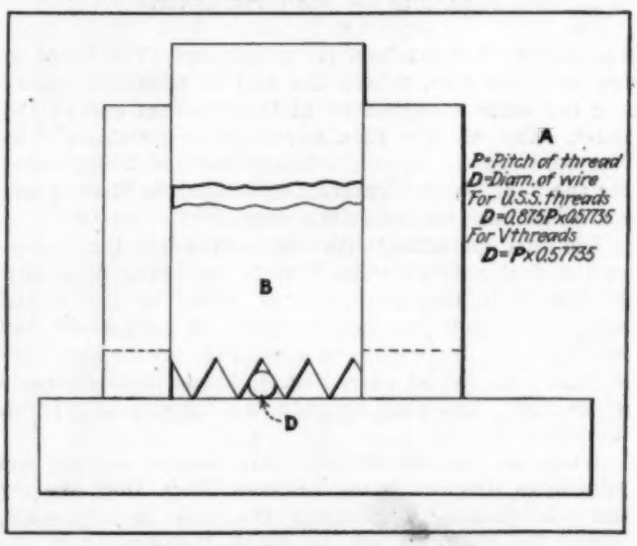
A typical installation of electrically-heated, automatically-controlled melting pots is shown in the illustration. The equipment takes care of the babbitting of bearings for approximately 1,300 street-railway cars. The automatic control of the pots makes the operation very easy, with comparatively little attention from the operator. The watchman turns on the heating current about an hour before starting time in the morning, so that when the workmen arrive, the pots are up to temperature and ready for operation. A constant temperature is maintained throughout the day, fresh babbitt being added regularly.

A Method of Checking Threads

BY CHARLES KUGLER

In checking the threads of taps, I lay the tap on a surface plate and use a piece of wire of such diameter as will come flush with the tops of the threads when laid in them. The formulas at *A* in the illustration show how to find the sizes of wires for all pitches, both U. S. S. and sharp V-threads. At *B* is shown a chaser being checked by the wire *D*. The same method is used for taps.

In case the wire *D* is loose, either the pitch is too great, or in the case of U. S. S. threads they may have been cut too deep. If the wire projects beyond the tops of the threads, the opposite is the case.



How the threads are checked

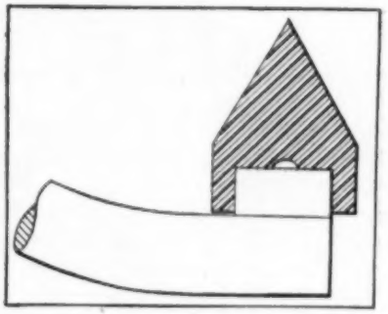
In determining the diameters of taps and reamers having odd numbers of flutes I proceed as follows:

For taps, I bore a hole in a piece of metal that will just allow the tap to slip in, then measure the hole. For reamers, I bore a hole and ream it with the reamer to be measured and then measure the hole.

Thread Measuring Attachment for the Micrometer

BY JOSEPH E. ABBAZIA

The ordinary form of micrometer is of little service for measuring threaded work, for the reason that it cannot reach the angular surfaces of the threads. A 60-deg. anvil, made to slip over the regular flat anvil of the micrometer as shown in the accompanying sketch, will allow such measurements to be taken. The attachment is very easy to make. Put a piece of drill rod of suitable diameter in the collet of the bench lathe and recess the end to fit tightly over the anvil of the micrometer, taking care to square the bottom of the recess accurately and making sure that it will contact with the face of the anvil at this point.



Micrometer attachment to measure threads

Next, cut off the piece to the required length, reverse it in the collet and turn the 60-deg. angle. The piece may be hardened and ground if thought desirable. In applying the tool, due allowance must be made for the height of the attachment when taking the reading.

An Undercutting Tool

BY WILLIAM VAN ASSEN

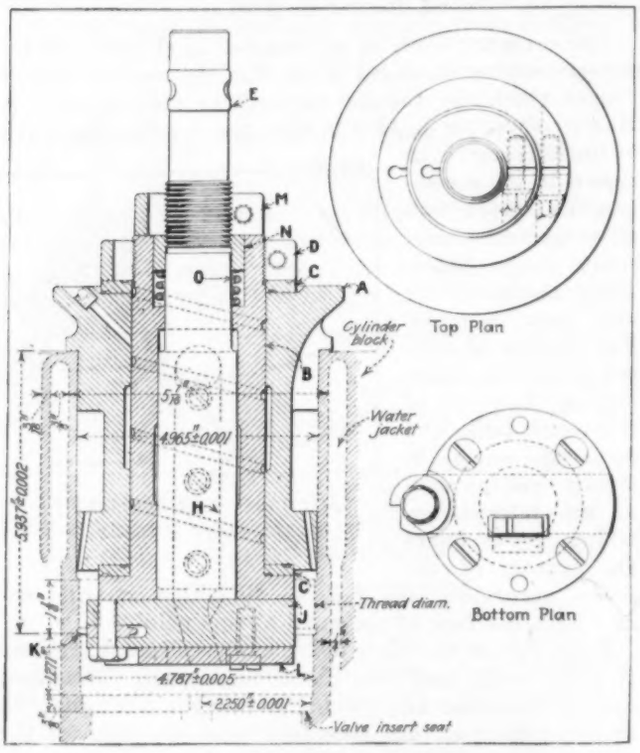
The tool shown in the illustration is for forming an undercut at the end of the cylinder-sleeve thread in the cylinder block of an aviation motor. The cylinder block is held on a fixture in an inverted position. The body *A* of the tool fits the cylinder bore and rests upon the bottom face of the cylinder block. The body is an iron casting and is beveled under the head to provide a convenient hand grip, in order to facilitate the handling of the unit.

The body remains stationary within the cylinder block, while within it rotates the sleeve *B*, which is oil-grooved and is provided at top and bottom with the oil-grooved, bronze thrust-washers, *C*, all held together by the lock nut, *D*. The slot in nut *D* is to be filled with wax after the machining and inspection have been completed. The reason for so doing, is to prevent dirt and chips from finding their way between the sleeves and the body.

The upper end of the driver *E* is fitted for use with a Magic chuck. To the lower end is fastened the cam *H*, which causes the tool slide *J*, carrying the cutter *K*, to move sideways, thereby feeding the cutter into or out of the work.

The flange of the sleeve *B* has a slot milled across its width to accommodate the tool slide *J*, which is retained in position by the plate *L*. The sleeve *B*, together with the cam *H* and the tool slide *J*, is caused to rotate by the driver *E* which has a shoulder to limit its upward travel—thus always keeping the tail of the cam *H* in the slot of the tool-slide, through which the driving torque takes place.

The downward travel of the driving shank *E* is controlled by the stop collar *M*, directly under which is located the sleeve, *N*. The sleeve *N* is a snug sliding



Tool for undercutting

fit in the sleeve *B*, and is held up against the stop collar *M* by the action of the spring *O*, thus keeping all dirt and chips out of the internal part of the tool.

In operation, the tool is placed within the cylinder and the drill press spindle attached to the driving shank by means of a Magic chuck. As the spindle is fed downward, the tool-slide and the cutter are advanced outward by means of the cam. The stop collar controls the diameter of the undercut. When the drill-press spindle is raised, the cam will withdraw the cutter from the work, and the entire tool may then be removed from the cylinder.

An oil cup is provided in the body, through which oil is admitted to lubricate the surfaces between the revolving sleeve and the body. Cutting lubricant is admitted through a slot provided in the top of the body. The lubricant flows downward and passes through the lower part of the body by way of the four oil holes drilled at an angle, so that in leaving the holes it is directed against the cylinder wall. The lubricant then flows down the cylinder wall and comes in contact with the cutter.

Modern brass milling practice is to use a positive rake and a steep helix angle on the cutting edge. This combination is said to give a better finish and a much longer life than the older type of cutter.

Tools for Making Sheet-Steel U-Bars

By John Strama

The illustrations are of a set of tools for making the U-bar shown in Fig. 1. The material is sheet steel 0.060 in. thick, 19¾ in. long and 1 in. wide. The bars were formerly made in one piercing and two forming operations. Owing to the length of the bars, the forming operations were quite slow, so it was decided to find a method by which the output could be increased. The result was the tools and methods here shown, by which the production was increased nearly 400 per cent.

The piercing and shearing tools, Fig. 2, consist of the die-shoe *A;* the die *B;* the stripper plate *C;* the punch holder *D;* the punch plate *E*, carrying 16 punches; and the shear blade *H*.

The bending or forming rolls, Figs. 3 to 5 are geared together and form the bars in three stages as shown.

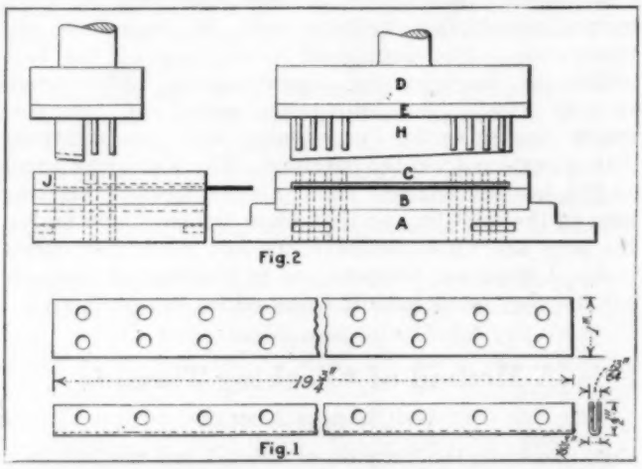
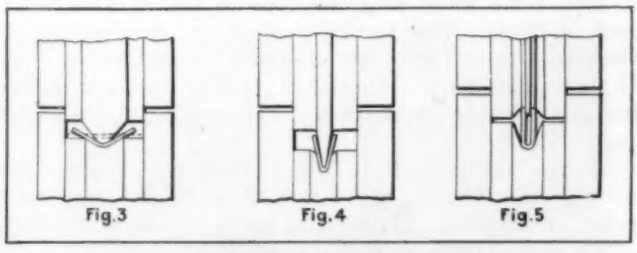


Fig. 1—The work. Fig. 2—The press tools



Figs. 3 to 5—The forming rolls

The order of operations is as follows: The sheet is fed into the dies, where the end is trimmed square and the holes are punched in the trimmed end of the sheet. The stock is then advanced to the stop *J*, the pierced blank is sheared off and the sheet is pierced for the next blank. Thereafter, a blank is pierced and cut off at each stroke of the press.

The next operation is forming or bending the blanks. In the first pair of rolls, Fig. 3, the blank is guided by flanges in the lower roll, as shown by the dotted lines. The pass through this pair of rolls bends the blank to an included angle of 115 deg. The pass through the second pair, Fig. 4, bends it to an angle of 25 deg. The pass through the third pair, Fig. 5, completes the bar.

While all the bottom rolls have flanges and the top rolls have tongues fitting between them, they are for the sole purpose of keeping the rolls in alignment, except for the first set, in which the flanges in the lower roll also serve for guiding the blank.

Design of Springs for Torsion or Flexure

Helical and Spiral Springs

Formulas for Computing Springs for Torsion

Load per deflection, lb./in. P_x/F_x	$\frac{P_x}{F_x} = \frac{kE}{R^2}\frac{d^4}{l}$	For ○ d wire $k=0.049$ " □ d " $k=0.083$ " b×d " $k=0.083\ b/d$
Safe maximum load, lb. P_m	$P_m < mS\frac{d^3}{R}$	For ○ d wire $m=0.098$ " □ d " $m=0.167$ " b×d " $m=0.167\ b/d$
Safe maximum deflection, in. F_m	$F_m < n\frac{S}{E}\frac{R}{d}l$	For ○ d wire $n=2.0$ " □ d " $n=2.0$ " b×d " $n=2.0$

Helical springs for torsion, as shown in Fig. 1, are used extensively where resiliency is required in a rotating part on the plane perpendicular to the axis of the spring. Spiral springs, as illustrated in Fig. 2, are employed principally as a means of storing resilient energy to be released gradually. This type of spring is valuable for springs for clocks and phonographs. The principal stress developed in the material of both the spiral spring and the helical torsional spring is flexural in character, and the formulas used in making computations are based on that assumption.

The coils of spiral springs are often closely packed, as in the ordinary motor spring, and as a consequence considerable friction is set up, which will disturb the results of the theoretical calculations. For accurate spiral springs, such as the hair spring of a watch, care is taken to space the coils

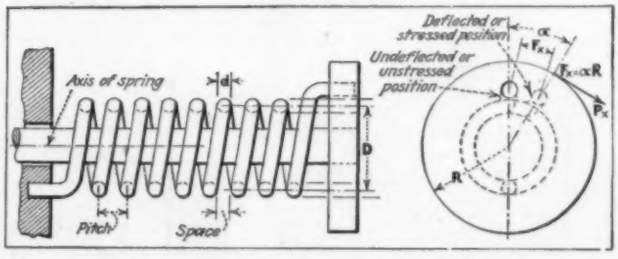


Fig. 1—Helical Spring in Torsion

apart to prevent touching at any time. The time regulation obtained from such a spring is due to its period when loaded with a balance wheel. This period is computed by means of the formula: Period in seconds $= \frac{2\pi}{\sqrt{g}}\sqrt{\frac{K^2W}{P/F}}$, where K is the radio between the "radius of gyration" and the length of the spring, W is the weight of the balance wheel in pounds, P/F is the load deflection rate of the spring, and g is the "acceleration of gravity," which is equal to 38.6 in. per second.

In using the formulas given in the accompanying table the modulus of electricity, E, is taken as 30,000,000 for steel wire of all compositions and tempers. Although one half of the wire section is under compression while the other half is under

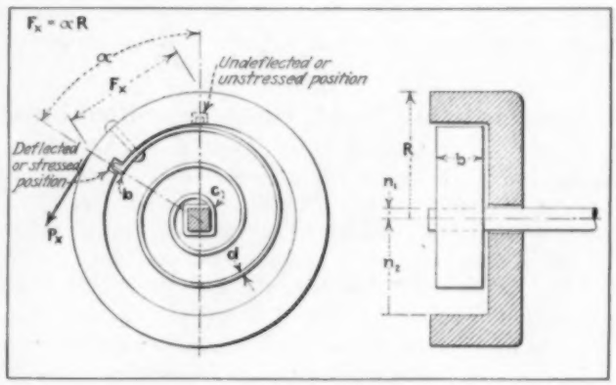


Fig. 2—Spiral Spring

tension, the error is inappreciable. The maximum safe tensile stress, S, varies with the grade and size of wire and with the conditions of service. A range of from 100,000 to 165,000 lb. per sq.in. should be used. For a spring of small diameter of wire to be operated only a few times a large value of S can be used, but for a heavy section spring to be operated a great number of times under load the smaller values of S should be used.

For calculating the length of the spiral spring shown in Fig. 2 it is customary to use the formula $L = 2\pi n\left(\frac{r_1 + r_2}{2}\right)$, where n is the number of convolutions measured from the points b to c on the spring. The length of wire in the helical spring, illustrated in Fig. 1, is calculated approximately by the formula $L = \pi nD$, where n represents the number of coils in the spring.

Contributed by Jos. Kaye Wood

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Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Plating with Cadmium

Q. Can you give me any information on cadmium plating? Is it similar to chromium plating?

A. Cadmium plating is a recent development, but it has no relation to chromium plating. Cadmium belongs to the same group of metals as zinc, and consequently is very soft, while chromium is best known for its extremely hard properties.

Cadmium has a very low melting point, and has been employed in making low-melting solders. The use of cadmium as a plating metal is to obtain a coating that will protect against corrosion. Cadmium is claimed to be much more resistant to corrosion and the action of acids than is zinc. A cadmium-oxide film is formed by the process, so that a thin plate will protect steel against the action of rust. The plating process is rapid, and cadmium plating will probably replace zinc and tin coatings in many places as a rust-proofing process.

Standardizing Employment Specifications

Q. We are continually having contentions between the foremen and our employment department regarding the type and qualifications of men hired and assigned to the various departments. Can you outline a method of tabulating or standardizing the qualifications for given jobs so as to eliminate the difficulties? I understand that this has been done in some shops already.

A. Several large manufacturing shops have made job analyses, and have written out specifications for different types and grades of workmen. These specification sheets are useful as a basis for judgment in the selection of men, but experience shows that no standards of any kind will ever offset the need of a discriminating knowledge of men, and a spirit of co-operation on the part of the employment manager.

The number of grades, types, and capacities of toolmakers, for example, as determined by the experience and training of the man and the class of work at hand, is almost unlimited. If the foreman desires, he can nearly always point out many places where the man hired does not fit the job. The employment department must be brought to realize that the general specification is only a tool for mass sorting, and that close co-operation with the shop cannot be eliminated if the best men to fit given jobs are to be hired. In other words the employment department is not an isolated unit in a well functioning plant.

A committee, made up of each foreman, and one or more individuals from your employment department, should be able to write out general specifications to fit all of the principal classes of work in the shop departments. With these specification sheets, as well as with his knowledge of the class and character of the men required in the plant, the employment manager can weed out any number of men from the applicants.

But when a foreman calls for a man, he may have in mind some particular job on a future order, and he may be in the best position to give the final judgment on the man to be hired. The employment manager should not feel that it detracts from his position to permit the foreman to talk with the selected applicants before one is finally hired. The latter may be a good man, but his experience may not fit the peculiar nature of the job at hand. These remarks, of course, apply chiefly to the hiring of trained mechanics, and do not necessarily apply to ordinary machine operators that are hired in quantity.

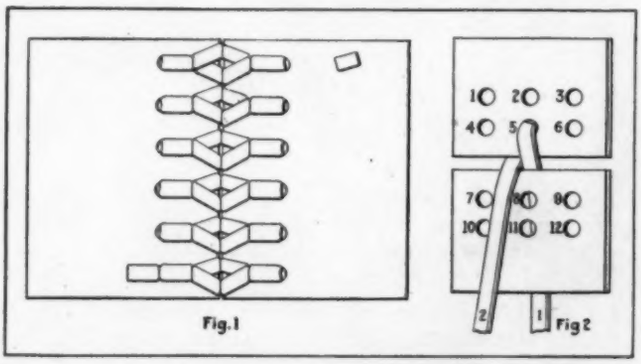
Lacing a Pliable Belt Joint

Q. Will you please describe the "hinge" method of lacing a belt?

A. The hinge method of belt lacing, when properly done, is very effective and produces a pliable joint. The finished lacing is shown in Fig. 1 in the illustration, and both sides of the belt are alike.

The holes should be punched as shown in Fig. 2, and spaced about ¾ in. from center to center. The holes should be not less than ½ in. from the end and edges of the belt. Begin in the center when the spacing of holes is odd, or in either one of the two center holes when the spacing of holes is even.

Pass lace end 1 up through hole 8, down between the ends of the belt, up through 5, down through 2, up through 5, and down between the ends. Pass lace end 2



down through 8, up through 11, down through 8, up between ends, down through 4, up between ends, down through 7, up between ends, down through 4, up through 1, down through 4, up between ends, down through 7, up through 10, down through 7, up between ends, down through 4, and up through 1. Then fasten the end in the usual manner through a small slit back of No. 1 hole.

Next proceed to finish the other side by running lace end 1 up through hole 9, down between ends, up through 6, down between ends, up through 9, down through 12, up through 9, down between ends, up through 6, down through 3, up through 6, down between ends, up through 9, down through 12, and fasten back of hole 12.

Technical Abstracts

The Possibilities of Chromium Plate

One of the best ways to render counterfeiting more difficult is to have all genuine bills of a given design absolutely identical. Any defect observed in a single line or dot is then an indication of counterfeiting. To produce such perfect impressions, the "intaglio" plate printing process is employed.

The surface of the plate is coated with ink and then wiped off, leaving ink only in the lines. When the paper is then pressed upon the plate, the ink is picked up, giving sharply defined lines in print. There is considerable abrasion from the particles of pigment in the inks, and case-hardened steel plates usually yield only from 30,000 to 70,000 impressions.

At the Bureau of Engraving and Printing a layer of chromium only 0.0002 in. thick is now being deposited electrically on the plates. Chromium has been found to be the hardest of metals, and electro-deposited chromium has a diamond-like hardness. The chromium plated printing plates give twice as many perfect impressions as the case-hardened plates, and thus give a more nearly uniform currency.

The possibilities of chromium lie in its great hardness, and hence its suitability for dies, gages, cams, and gears. Its high luster and resistance to tarnish also render it useful for reflectors, automobile radiators, plumbing fixtures and other objects. It seems certain that within a few years it will become commonplace, instead of being a chemical curiosity.—*Research Narratives*, Vol. 6, No. 10, Oct. 1.

Remuneration For Consulting Engineering Service

When a person is ill and goes to see a doctor he expects to pay a fee for consultation, even though the advice he gets may do him no good. When a lawyer is consulted, a retainer is always in order.

Consider, as a contrast, the mechanical consulting engineer. If he is worthy of the name he must not be much under forty years of age, with at least twenty years of practical experience behind him—else his advice might not be of much practical value. Yet, if a manufacturer comes to his office he sits down and talks over his problem with the engineer, and possibly obtains a solution of it, without paying a cent.

I have known plenty of cases where the greater part of a day would be spent in going over some problem without a hint on the part of the customer that he might be taking up valuable time and getting some important data. In very few cases is the engineer paid for this sort of work; it is considered "all in the game," and the customer would in all probability feel offended if asked for a $25 fee for the day's work. Yet this would be a very moderate charge in any other kind of professional consulting work—*Machinery*, October, p. 99.

Suggestion Plan as a Basis for Growth

One of the greatest problems that companies have is the developing of employees for bigger positions, not only for the good reaction it has on the employees but because companies benefit most by building their personnel from within. One way is to have a suggestion system that will stimulate employees to think about ways for improving the company's practices. One company publicly acknowledges suggestions and remunerates them in proportion to their value.

Weaknesses found in the old systems were the delay in acting on suggestions, the difficulty of fairly judging the values of diversified suggestions and the absence of power to act on some suggestions. To overcome these difficulties, a suggestion committee was appointed with power to act on the suggestions. Sponsor committees were appointed to aid the suggestion committee. The sponsor committees consist of men properly qualified to judge the practicality of the suggestions.

In making suggestions, the employees must use a standard printed form which consists of two parts. The suggestion form itself is numbered and does not contain the name or address of the employee making the suggestion. He tears off a coupon and when the decision on the suggestion is made he sends in the coupon bearing the same number as the suggestion form and containing his name and address. The suggestion form contains also a list of subjects concerning which suggestions are desired. This list has been found to stimulate the making of suggestions. The use of the form containing the suggestion without the name or address of the employee precludes any chances of favoritism.—*Electrical World*, Nov. 6, p. 957.

Design of Positive Clutches

The calculations of positive mechanical clutches for machine tools consists at present merely in the calculation of the strength of the teeth, but it is of far greater importance to figure the number of teeth on the basis of the coupling time. No information seems to be given in the standard handbooks for such calculations.

To obtain the proper action of the teeth it is important to design their frequency in relation to the actual time of coupling. This is important in an automatic machine to prevent noise and excessive wear. The average time of coupling for a clutch in an automatic machine has been found to be 0.05 second.

The shape of the coupling tooth is also important. The straight saw-tooth and the straight-side notch tooth are much used, but they have the disadvantage of becoming marred in use. To correct this the edges are well rounded in both mating parts of the clutch. The number of teeth in a clutch is found by dividing the time of a revolution in seconds by the coupling time in seconds.—Rud. Strössner, in *Die Werkzeugmachine*, (Berlin), Sept. 15, p. 417.

The Polish Machine Tool Industry

Before the World War the machine tool industry in Poland was in a low state of development. The parts of Poland under Austrian and German dominion were hampered by the adverse industrial policy of the rulers, while in Russian Poland there was but one modern plant, which at the time of the Russian retreat was evacuated with its machinery and personnel.

The German occupants divested the metal working factories of their stocks and manufacturing appliances. All raw materials and machine tools were confiscated and transported into Germany. It can be said that on the eve of the reestablishment of the Polish State the metal-working industry did not exist, and that the steel furnaces stood idle.

At the termination of the war the engineers gave their efforts towards reorganizing the ruined factories. The Ministry of Industry and Commerce was instrumental in starting a few factories in the manufacture of machine tools by placing orders, supplying raw materials, and by advancing funds.

The present knowledge of the production of machine tools in Poland is due in great measure to the initiative taken by Polish emigrants to America. The largest machine tool manufacturing plant that has been established in Poland is the Polish Mechanics Co., with factories at Pruszkow and Poremba in which are 1,500 employees, and which in the last three years have produced 1,537 machines.

Confidence in Polish factories has grown rapidly, and they are becoming more proficient in construction methods, and are improving the types of machines. Aided by a moderate customs' tariff local firms can compete in price with foreign manufacturers on higher grades of machines, although they find some difficulty in competing with German producers of second rate machine tools. However, the hard task of laying the foundations of the industry has been accomplished.—Jerzy Iwanowski, in *Poland*, Nov., 1926, p. 671.

American Machinist

KENNETH H. CONDIT AND FRED H. COLVIN
Editors

Established 1877

The Purchasing Agent

THOSE who have come to think of the purchasing agent only as a nuisance and an obstructionist, will do well to read what Mr. Godfrey has seen and heard about them in his travels. In considering the P.A.s who so far forget the best interest of their firms as to buy on price alone, as representatives of P.A.s as a class, we are wronging a group who play a real part in securing economical production.

It is just as much a part of modern production to know where to secure desired materials as to know how to use them to advantage after we have them. As in so many instances, both are needed to secure economic production. It is simply another indication that understanding and cooperation between departments, as well as knowing the individuals of a department, are necessary in order to secure the best results.

Free Service?

A LETTER from a purchaser and user of machine tools brings to mind the old complaint of inordinate demands for free service on machine tools, but from a rather different angle. This purchaser received two standard tools, of different makes, in such shape that they were of very little use. They had not been damaged in transit, either. The faults were due entirely to poor workmanship and lax inspection. Naturally, the buyer was annoyed.

Judging from the letter in question the builders of these two tools ought to be very grateful for an opportunity to make them right without cost to the customer. Free service—yes, but service that should have been unnecessary.

If the price at which the machines were sold was insufficient to pay for ordinarily decent workmanship there is certainly something wrong with the profit ideals of the builders.

Let's Not Stampede Coal Prices

BITUMINOUS coal prices have risen suddenly and rapidly in the last few weeks. If industrial buyers become panic stricken and start bidding against each other to set up reserves, they will precipitate all kinds of trouble. Prices will skyrocket and the uneconomical "margin" mines will come into the market and break it, as they have in the past but in the meanwhile too much will have been paid for the coal purchased.

While it is unquestionably wise to buy coal for reserves, whenever it can be had at a fair price, to be prepared for the strike that will almost surely be called next spring, there is nothing in the present situation to become panicky over. Production is at the highest rate in five years. The railroads are better able to move the coal mined than at any time in their history. Though unusual quantities are being exported to England's markets not enough is being sent there to justify the present excited buying and these will dwindle rapidly now that the English coal strike has been concluded.

Obviously it is well to be prepared for future needs but not at the expense of a runaway market.

Something for Nothing

THE Federal Trade Commission has made the statement that it intends to institute a compaign against false and misleading advertisements, and amongst other things mentions that "fake industrial schools are numerous, and their advertisements hold out alluring but false promises of lucrative employment after casual effort and study."

Mechanical men are interested in correspondence schools, and their benefit to thousands of workmen, who otherwise could not get the schooling, is undeniable. But the danger of monetary loss to the worker is more in the method of application than from the outright fake of an unscrupulous school.

Few applicants for correspondence courses realize that to complete a mechanical course involving mathematics and mechanics without the aid of the personal contact of a teacher requires infinite pains and application, not to speak of hours of labor. Workmen should be discouraged from taking out and paying for long and complicated courses such as mechanical engineering, which is equivalent to a four years' college course, and which few would ever finish.

Certainly it seems obvious that a sane procedure is for the workman to take out at first the smallest unit of the course that is permissible. If, then, he finds it possible to complete "mechanical drawing," he can proceed on a course in higher mathematics, followed by the other sections or courses in turn. This method would prevent the excessive waste of money and shattered false hopes from uncompleted correspondence courses.

How Soon Should New Equipment Pay for Itself?

Shop Equipment News

Norton Improved Universal Tool and Cutter Grinding Machine

The universal tool and cutter grinding machine shown in the accompanying illustration has been redesigned by Norton Co., Worcester, Mass. Individual motor drive has been adapted for each operating unit by building the motor directly into that unit.

Three motors provide power for the various drives. The double-end wheel spindle is driven by a ½-hp. constant-speed motor arranged on a platform in the base of the machine. This platform is attached to the wheel column so that the motor is held in the same relation to the wheel spindle at all times. The hollow column through which the belt passes also affords a complete protective guard. In Fig. 2, the position of this motor inside the base and the spring idler that maintains the desired belt tension can be seen. This motor is controlled by means of a switch located on the door at the front of the base.

The headstock is equipped with a 1/20-hp. adjustable-speed, direct-current motor that provides a range of work speeds from approximately 200 to 350 r.p.m. A push-button switch is used to stop and start the motor, but speed regulation is obtained by means of a field rheostat mounted on the base of the machine.

The table is automatically traversed by a ⅛-hp. adjustable-speed, direct-current motor built into the traverse mechanism. Fig. 3 shows the arrangement of the drive with the covers removed. Variations in motor speed are obtained by means of a field rheostat attached to the front of the base and in addition change gears provide a power-traverse speed range of approximately 70 to 392 in. per minute.

When direct current is not available for the adjustable-speed headstock motor and the table-traverse motor, a generator is installed in the machine base to provide this current. In that case, a 1-hp. motor replaces the smaller motor regularly used for the wheel drive, and the generator is coupled direct to this motor shaft.

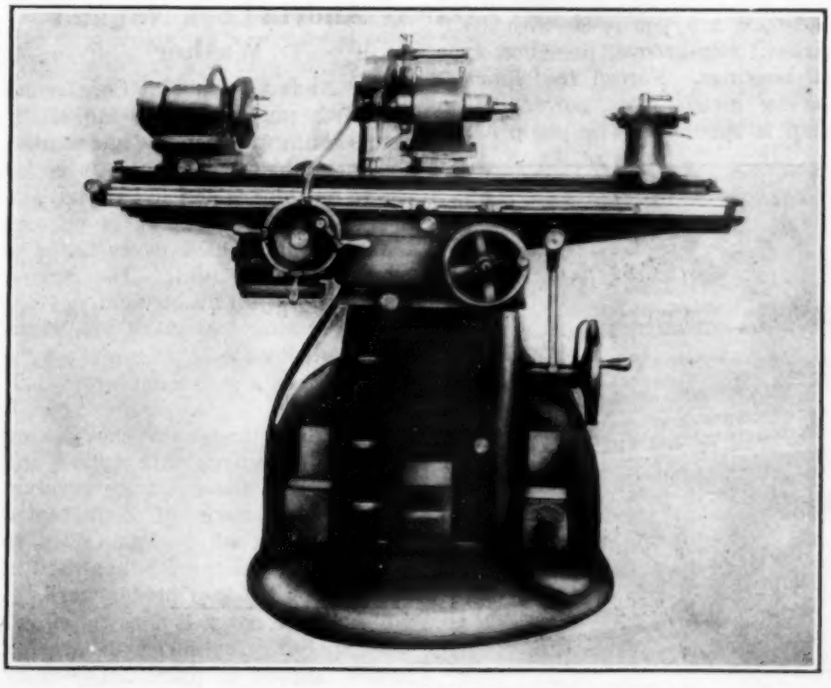


Fig. 1—Norton Universal Tool and Cutter Grinding Machine, Improved

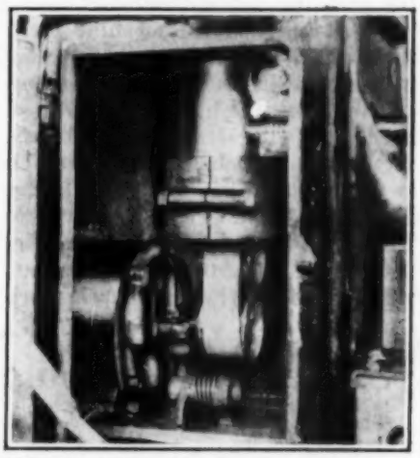


Fig. 2—Wheel drive motor mounted in base of machine

The length of the table has been increased to permit the mounting of work 36 in. in length between centers, and to provide a table traverse motion of 32 in. for both cylindrical- and surface-grinding operations. The cross feed motion of the table is 8½ in., and a vertical movement of 8 in. for the wheel column can be obtained. Work 12 in. in diameter can be swung on centers. The maximum size of face cutter or similar tool that can be ground, while it projects over the edge of the table, is 14 in. in diameter.

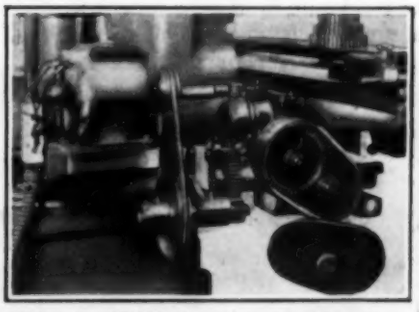


Fig. 3—Table traverse mechanism

An additional feature is provided in a lever for moving the table in short strokes. By means of this lever, which is long and located in a convenient position, the operator can easily move the work past the wheel in cutter- and other tool-sharpening operations. For longer hand

Shop Equipment News

traverse motion, a pilot handwheel is provided that operates through a fast or slow speed as desired, to suit the grinding requirements.

Adaptability of the machine for a wide variety of work is obtained by means of adjustments in the setting of the tables, the height of the wheel head and the universal fixtures regularly supplied. The table can be swung through an arc of 150 deg. For taper grinding the swivel table is pivoted the desired amount by means of a delicate adjustment, while for face plate or chuck work the headstock is swiveled to obtain the necessary taper.

Some of the fixtures included are: a combination attachment adapted for a variety of tool-sharpening operations, a universal vise for holding work for surface grinding, a three-jaw chuck of 6 in. capacity for internal- and cylindrical-grinding operations, an internal-grinding spindle, center rest, tooth rests, wrenches, wheel sleeves and wheels.

Where the machine is to be used on certain classes of work only, these fixtures may be omitted.

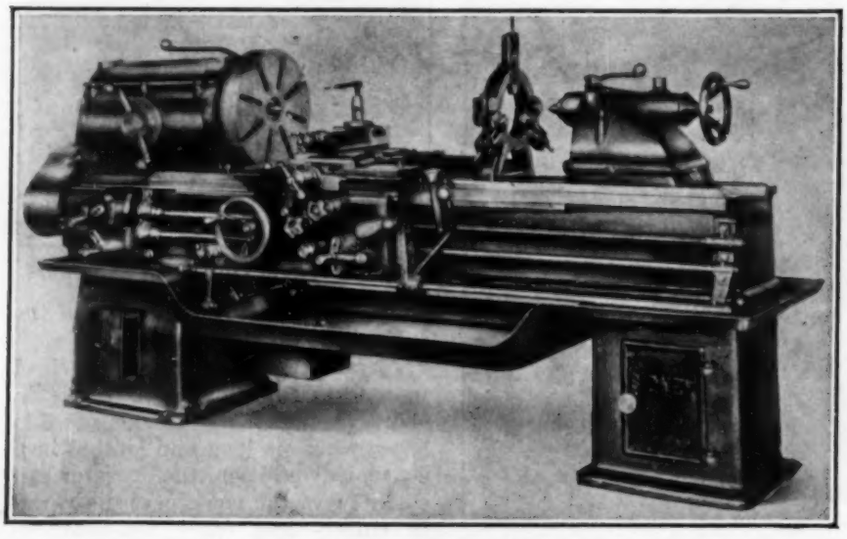
Sidney Ball-Bearing Geared-Head Lathe

The Sidney Machine Tool Co., Sidney, Ohio, is marketing the ball-bearing geared-head lathe shown in the accompanying illustration. The outstanding feature of the machine is the control of the geared headstock, which is by means of a single lever. Eight spindle speeds are obtainable, and the changes from one speed to the other can be made while the spindle is in motion. In the neutral position of this lever a positive-acting brake is applied. A similar arrangement is provided for the apron control levers.

In the headstock, at least four gears are in mesh at all times, and because of this it is claimed that there is positive freedom from tool marks on finished cuts. All the gears are heat-treated, hardened, and ground to insure long life and accuracy. The apron is of the double-plate type with bronze bushed bearings for the gear studs. With the double-plate design each shaft has a bearing on either side of the gear. Mechanical apron control is part of the standard equipment.

Drive is furnished from a motor mounted inside of the cabinet leg on an adjustable shelf, so that it acts as a belt tightener. A belt 4½ in. in width drives to a multiple-disk clutch pulley 10 in. in diam. by 5 in. face. This belt is totally inclosed in metal guards. Single-pulley drive without the motor in the base can also be provided.

The drive shaft, intermediate shaft, and all thrust bearings in the headstock are equipped with SKF marked, deep-groove, precision type ball bearings. Forced feed lubrication by means of a power driven pump is supplied. The pump has a capacity of 10½ gal. of oil per hour and is equipped with a strainer and purifier. Every moving part is thus positively lubricated.



Sidney Ball-Bearing Geared-Head Lathe

The machine is built in bed lengths ranging from 8 to 30 ft. Specifications for the 8-ft. machine follow:

Swing over Vs	19¼ in.
Swing over carriage	12⅛ in.
Swing over compound slide rest	10½ in.
Hole through spindle	1⅝ in.
Morse taper of centers	No. 5
Range of threads, quick-change gear box	2 to 56 per in.
Feed range, in. per rev.	0.005 to 0.150
Tailstock spindle traverse	9 in.
Tailstock spindle set-over	1 in.
Tailstock overhang capacity	4 in.
Steady rest opening	6¾ in.
Compound rest slide travel	4½ in.
Size of lathe tool	⅞x1½ in.
Drive shaft speed	340 r.p.m.
Minimum spindle speed	12 r.p.m.
Maximum spindle speed	317 r.p.m.
Horsepower required	5
Motor speed recommended, constant-speed motor	1,160 r.p.m.
Motor speed recommended, variable-speed motor	500 to 1,500 r.p.m.
Distance spindle center to floor	42½ in.
Maximum distance between centers	48 in.
Taper attachment, maximum taper per foot	4 in.
Taper attachment turns at one setting	20 in.
Bed length overall	8 ft. 4 in.
Weight	4,400 lb.
Weight each 2 ft. additional	350 lb.

Andrix Lock Nut and Washer

The Andrix Lock Nut Co., Locust and Michigan Streets, Adrian, Mich., is marketing the lock nut and washer shown in the illustration. It is for use in machinery and in railroad and bridge construction. It is claimed that these locks have never failed to hold the nuts tight. The spring washer takes up all stretch.

The washer is made of high-carbon spring steel. It has a tongue that engages a spline cut in the bolt body.

A similar tongue in the locking piece also engages this spline and thus prevents the nut from turning. The lock is made of heat-treated crucible steel and is Parkerized to withstand the elements when used in the open on track or bridge work. It will not rust nor will it rattle off.

In applying the device the washer is first slipped in place, followed by the nut, which is then tightened with

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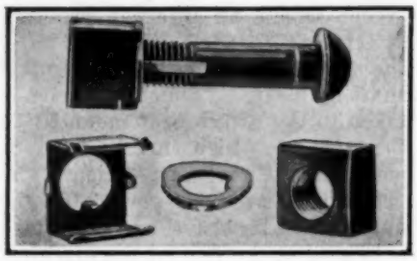


Andrix Lock Nut and Washer

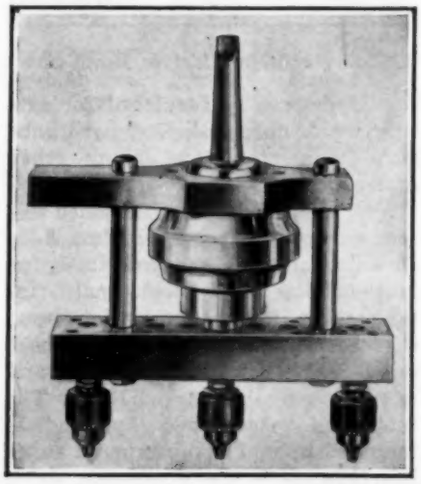
one of the flat sides of the nut in line with the spline in the bolt. The locking piece can then be snapped in place. Four prongs grip the underside of the nut and prevent the lock from falling off. To remove the device, a screw-driver or other edged tool is inserted under the side of the lock close to the lower edge so as to spring the prongs free. These lock nuts may be used over again as often as is necessary.

The lock nut is made in both square and hexagon types in four sizes: ⅞, 1, 1⅛ and 1¼ inch, to fit standard nuts of the same sizes.

Jarvis Multiple Tapping Head

The Chas. L. Jarvis Co., Gildersleeve, Conn., is marketing the multiple tapping head shown in the accompanying illustration.

This head can be made up with 2 to 6 spindles. The center distance can be set as low as ⅞ in. in which case the chuck is removed and collet bushings are used to hold the taps. The head is designed to take care of taps up to ⅝ in. in size.



Jarvis Multiple Tapping Head

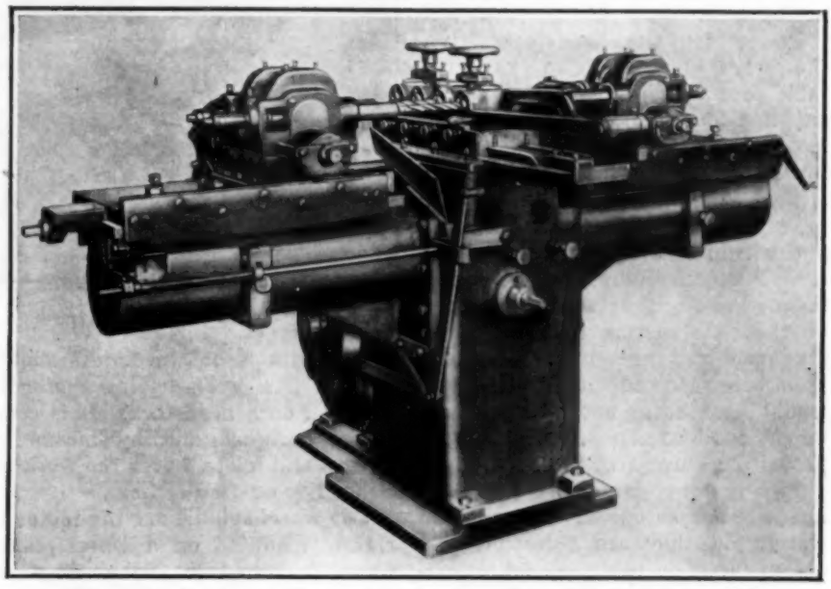
"Hole Hog" No. 19 Horizontal Duplex Piston-Drilling Machine

The "Hole Hog" No. 19 horizontal duplex piston-drilling machine shown in the accompanying illustration has been built by the Moline Tool Co., Moline, Ill., with four standard heads and a jig for drilling wrist-pin holes in automotive pistons.

The machine consists of a pedestal to which two side members are bolted, thus forming a long bed, running longitudinally through the center of which is mounted a large shaft. On this shaft are carried two drum cams shaped to give the desired traverse to two slides, one on either end, mounted on the ways of the bed. The slides are constructed to carry standard drilling heads driven by spiral gearing. Each head has independent lateral adjustment so that the spindle can be shifted to take care of the wear of drills.

A 7½-hp. motor, running at 1,200 r.p.m., mounted on the base of the machine drives a countershaft on the side of the bed by means of a belt. This shaft is mounted in radial ball bearings to insure a smooth and quiet drive, and from it the power is transmitted to the spindles through a system of spiral gearing. The feed motion is also derived from the main shaft and is transmitted through proper gearing to the cams. Both slides feed in simultaneously and the cams are designed to give a complete cycle consisting of quick approach, slow feed, and quick return to the drills.

A roller mounted on the slide engages a groove in the cams so that the motion of the slide is controlled thereby. Those parts of the cam that do the heaviest work are made of hardened steel. The two slides are independently adjustable.



"Hole Hog" No. 19 Horizontal Duplex Piston-Drilling Machine

The jig is designed to carry four pistons and is mounted on a sliding plate actuated by a lever. Two pistons are drilled at one time, while two are being loaded. The spindles return to the starting position, the jig is indexed over to the other position and the cycle is repeated. The time for a cycle is 45 seconds.

The machine can be set to repeat the cycle without stopping or it can be set to stop automatically at the end of each cycle. The pistons are centered in the jig by means of a cam clamp operated through knurled knobs shown just below the drills in the illustration, and are clamped by the two handwheels shown on top of the jig. Each handwheel clamps two pistons.

The machine occupies a floor space of 8 ft. 8 in. by 4 ft. 8 inches.

Shop Equipment News

Brown & Sharpe Motor-Driven Universal Grinding Machine

Complete motor-equipped universal grinding machines in sizes Nos. 2, 3, and 4 are being made by the Brown & Sharpe Manufacturing Co., Providence, R. I. A typical machine is shown in the accompanying illustration, Fig. 1. The machines are completely self-contained and independent units. They are particularly recommended for installations where overhead line-shafting cannot be used.

Power for the headstock drive, the wheel-spindle drive and the table feed drive on each machine is supplied by three individual electric motors. These motors are controlled by a single push-button switch located at the front of the machine near the regular machine controls and within easy reach of the operator. Protective plugs, located in the magnetic-switch control box mounted on the base casting at the rear of the machine, prevent the motors from being burned out through overload. Any motor not required may be cut out by removing one of these protective plugs from this switch.

The motors are amply protected against the intrusion of grit and water, yet they are accessible and are mounted in position so that efficient delivery of power to the operating parts is obtained. As shown in Fig. 2 a work-driving motor is mounted on a headstock. It is compactly designed and by means of pulleys and idlers drives the work on either live or dead centers.

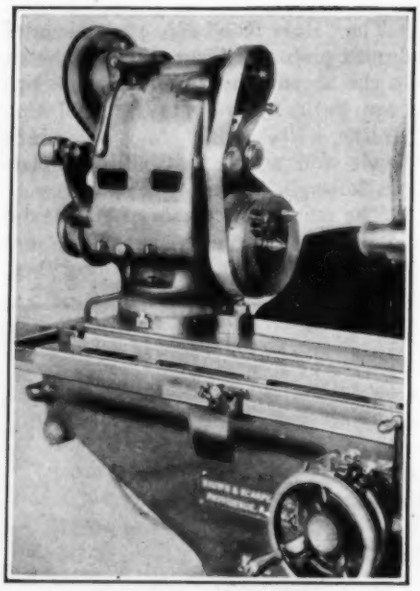


Fig. 2—The headstock drive

The wheel-spindle driving motor is rigidly mounted on a wheel stand, which is bolted to the wheel-stand platen. The drive is direct from the motor pulley to the spindle pulley, except where an internal grinding attachment is used. In that case, the spindle is replaced by a countershaft by means of which the drive is taken to the attachment mounted on the platen, which must then be placed in the reverse position. The motor that provides power for the automatic table travel and cross feed is located at the rear of the machine. This motor also drives the pump for supplying water for wet grinding.

Several types of constant-speed motors and various styles of control equipment are offered for use with both direct and alternating current to suit the requirements of the user.

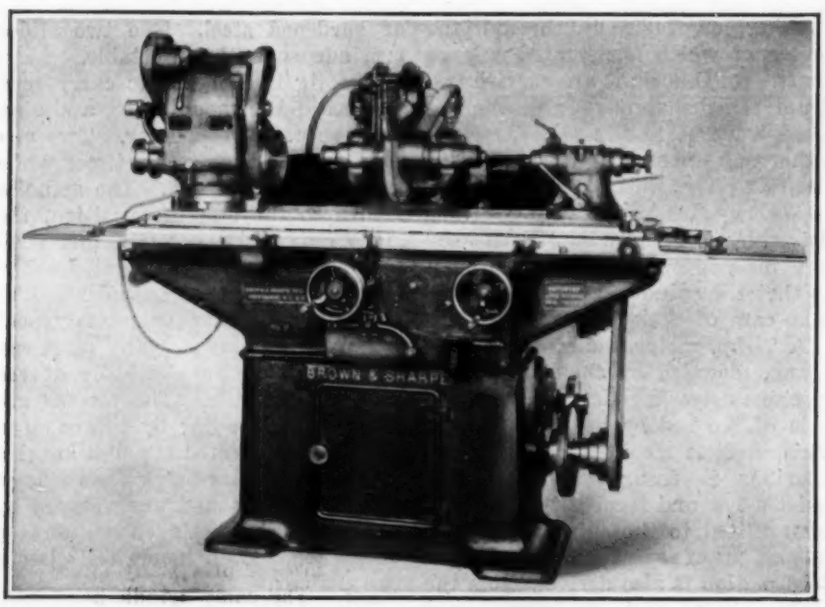
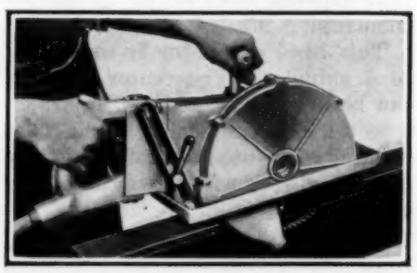


Fig. 1—Brown & Sharpe Motor-Driven Universal Grinding Machine

"Alta" Portable Electric Hand Saw

The "Alta" portable electric hand saw shown in the accompanying illustration is being manufactured by the Wappat Gear Works, Meade St. at Braddock Ave., Pittsburgh, Pa. It is for use in sawing lumber on construction jobs and in industrial plants. It is equipped with a powerful universal motor for use on either direct or alternating current and cross-cuts and rips boards up to and including 3 in. in thickness. Special saw blades can be furnished for cutting wood, fibre, bakelite, hard rubber, stone, steel, and many other materials.



"Alta" Portable Electric Hand Saw

Five saw blades are furnished unless otherwise specified: Two 8-in. combination saws, marked No. 1, for cross-cutting and occasional ripping; one 9-in. combination saw, marked No. 2, for the same purpose; one 8-in. rip saw, marked No. 3, and one 9-in. rip saw, marked No. 4. The motor is rated at ¾ hp. and is mounted upon Timken tapered roller bearings, as is the worm-gear drive to the saw spindle. Regular equip-

Shop Equipment News

ment includes 15 ft. of heavy-duty rubber covered wire and an armored separable attachment plug.

A particular feature of this device is a telescoping guard that completely incloses the blade and automatically opens only when the saw is pushed into the material. It closes again as soon as the cut is completed. This guard affords maximum safety against accident and protects the blade from damage as well. A wide carrying shoe supports the weight of the tool and prevents tipping, so that the chief effort of the operator is in guiding the saw. This shoe is made of pressed steel and is nickel plated. It is adjustable so that it is possible to set the saw for any depth of cut such as would be required when cutting out sections of flooring and the like. The presence of this shoe insures square cuts and prevents straining the saw blade, thus eliminating the danger of broken blades.

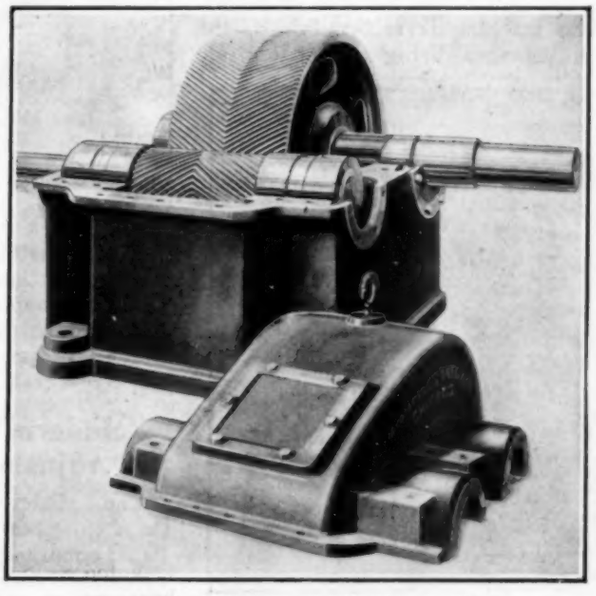
A blast of air from the motor ventilating fan is directed to the front of the saw to blow the sawdust away. The handles of the device are placed to give good balance and to eliminate wrist strain.

James Continuous-Tooth Herringbone Speed Reducers

The D. O. James Manufacturing Co., 1114 West Monroe St., Chicago, Ill., has developed a continuous-tooth herringbone gear for use in speed reducing units. This type of gear embodies the double helical principle, and as a result is similar in appearance to the joining of two single helical gears having opposed helix angles. Each individual tooth is brought to an apex and has the shape of a completed V. The tooth is not broken and the apex is not rounded to provide for tool clearance.

The tooth is generated with a curve or twist so that the same profile is presented both in the normal plane at right angles to the helix angle and in the diametral plane at right angles to the face. This design is made possible by a special gear generator. The teeth are of involute form and are cut with a 20-deg. pressure angle and a 30-deg. helix angle. The addendum of the tooth is 0.8 divided by D.P. and the dedendum is 0.1 divided by D.P. Due to the continuous form, end thrust is neutralized. An overlap of approximately 50 per cent is obtained, so that the tooth action is smooth, continuous and noiseless, and no shock is produced when the load passes from one tooth to another. Two teeth are always in mesh in the plane of the axis.

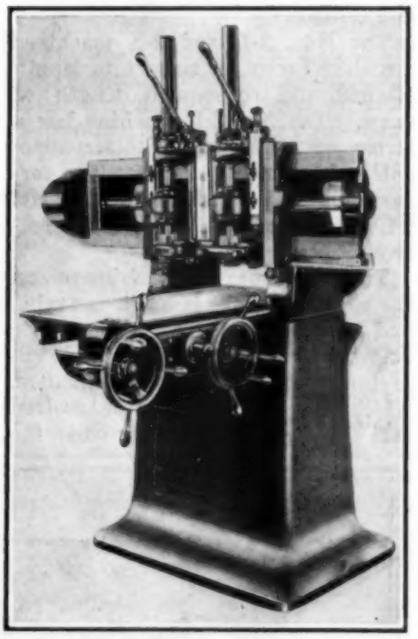
It is said that the load is distributed over the full width of the teeth, and consequently large loads can be carried by small gears with high efficiency. For the same reason, greater reduction ratios can be obtained, together with high rim speeds, longer life, less power consumption, and less space is required because fewer reductions are necessary. Backlash and play are also practically eliminated. These continuous-tooth herringbone gears are being built into reduction ratios ranging from 2 to 1, to 150 to 1, and carrying loads from 2 to 200 hp. They are built to meet the demand for heavy, rugged, durable types for such service as rubber, glass, chemical, lumber, paper, sugar and similar manufacturing processes.



James Continuous-Tooth Herringbone Gear Reduction Unit

Pratt & Whitney No. 12 Profiler, Improved

The No. 12 profiler shown in the accompanying illustration has been improved by the Pratt & Whitney Co., Division Niles-Bement-Pond Co., Hartford, Conn., so as to greatly increase the range of the machine and to adapt it to a number of profiling jobs that are of a light nature as regards touch, but that require an extra amount of work surface. Hence the table has been made longer and wider in order to carry larger work.



Pratt & Whitney No. 12 Profiler, Improved

The two handwheels, by means of which the table traverse and spindle-head traverse, respectively, have been controlled, have both been brought around to the right side of the machine within convenient reach of the operator. The remainder of the machine is practically as it was before. The same spindle-head and spindle ways are used and the two spindles are still driven through

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spiral gears from a horizontal driving shaft. Each spindle is equipped with a former pin holder and the necessary depth stops and controls. The traversing mechanism for the spindle head has been changed, however, and consists of a handwheel geared to a shaft running through to the back of the machine. This shaft operates a gear reduction unit that is connected to a rack and pinion in the usual manner, except for the increase in length of travel.

The table is 18¾ in. wide and 42 in. long and has a travel of 40 in. The maximum height from the table top to the bottom of the cross slide is 5¼ inches.

Lapointe Nos. 2-L and 2-S Hydraulic Broaching Machines

The J. N. Lapointe Co., New London, Conn., has added to its line two hydraulic broaching machines, Nos. 2-L and 2-S, designed for work that does not require either the range or the pulling capacity of the larger machine, No. 3-L described on page 654, Vol. 64, of the *American Machinist*, but identical with that machine in the matters of mechanism and control.

The Nos. 2-L and 2-S machines are alike except in respect to length of bed and consequent length of draw. The No. 2-L machine has a stroke of 48 in. and will accommodate a broach 52 in. long. The corresponding dimensions of the No. 2-S machine are 30 and 34 in. respectively.

The maximum rate of travel on the working stroke is 33 ft. per min., and it can be regulated to any rate below that maximum by a simple adjustment of the control mechanism, which can be locked at the desired rate to prevent injury to the broaches by too fast a cutting speed. The movement may be stopped upon completion of the whole or any part of the stroke, or may be set to return automatically to the starting position.

The pulling capacity at an oil pressure of 1,000 lb. per sq.in. is 15,000 lb. The return stroke may be made at any rate below a maximum of 180 ft. per min. by a simple movement of the control lever.

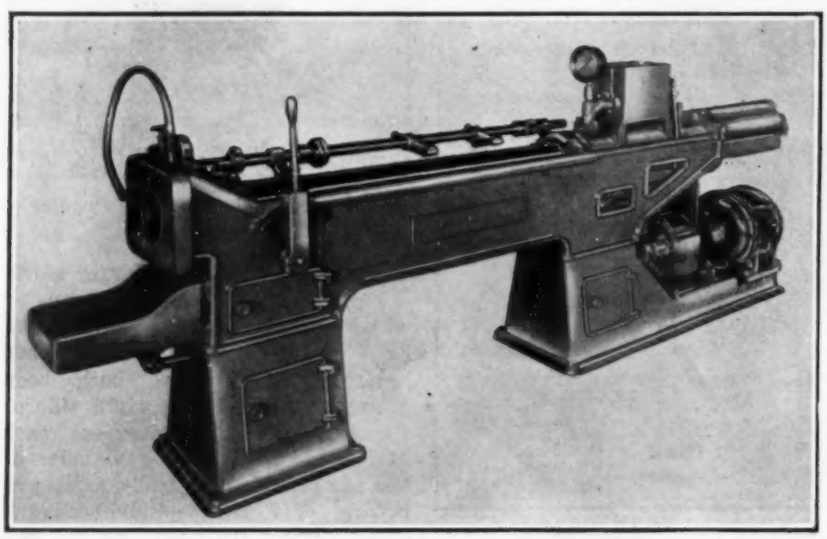
Power is supplied by a Hele-Shaw variable-delivery pump direct connected to an electric motor. This motor is mounted upon an extension of the rear leg and is covered by the overhang of the hydraulic cylinder as may be seen in the illustration. A 5-hp. motor, running at a speed of 900 r.p.m., is recommended.

The hole in the faceplate is 5 in. in diameter. There is a vertical adjustment of the drawhead of 1⅛ in. above and below the line of center. The machine is self-contained, the oil passages being almost entirely within the cylinder casting, and is ready to run as soon as the system is filled with oil.

The compensating reservoir is mounted above the cylinder and is open to the atmosphere. It is of sufficient capacity to take care of the volumetric changes of the oil due to its movement from one side of the piston to the other.

A Brown & Sharpe geared pump, driven from the motor, supplies cutting compound to the broaches. The reservoir for the compound is in the cabinet leg of the machine, and is provided with settling basins and baffle plates to keep the liquid clear. A removable screen in the compartment above the reservoir prevents entrance of the chips from the broach. This screen can be removed conveniently for cleaning.

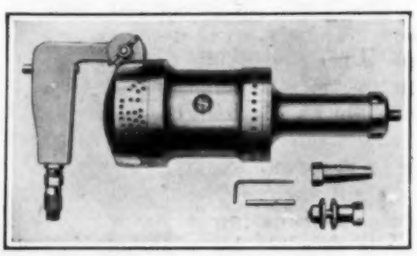
The weights of the machines are 3,500 and 4,200 lb., and the floor spaces occupied are 102x20 in. and 132x20 in. respectively.



Lapointe No. 2-L Hydraulic Broaching Machine

"U.S." Portable Die Grinder

The United States Electrical Tool Co., Cincinnati, Ohio, has developed a portable grinder for use in grinding dies, welded parts, fins on light castings, and on other parts where speed and accuracy is required.



"U.S." Portable Die Grinder

The adjustable back handle permits operation within a limited space. The spindle speed under load is 11,000 r.p.m. The complete tool weighs 12 pounds.

"Modern" Single-Bladed Adjustable Reamer

The Modern Reamer Specialty Co., 2401 Chestnut St., Philadelphia, Pa., is marketing the single-bladed adjustable reamer shown in the accompanying illustration.

The tool consists of a solid body

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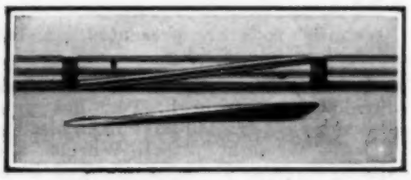


"Modern" Single-Bladed Adjustable Reamer

with a groove in which is inserted a single blade. This groove may be either spiral or straight. Set screws are used to hold the blade in position, both at the sides and at the bottom so that a large range of adjustment is available. In fact, it is possible to regrind the blade with an eccentric relief by displacing the blade somewhat forward of its cutting position. The amount of this eccentric relief can be governed by the set screws so that either a shallow or deep relief can be obtained as desired. Due also to this wide range of adjustment, the blade can be reground many times, and the life of the reamer is correspondingly lengthened.

The solid body insures proper alignment at all times. It also enables the reamer to be used as either a roughing reamer or a finishing tool.

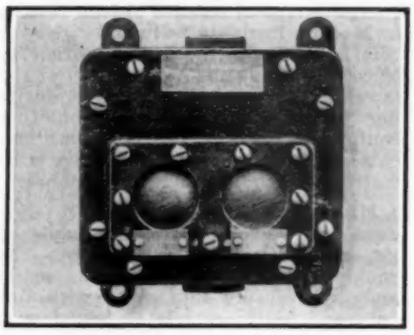
General Electric Push-Button Stations

A number of improved push-button stations for use with various types of industrial magnetic control equipment are being marketed by the General Electric Co., Schenectady, N. Y. These push buttons are for various fields of application and each is designed to meet some special set of conditions.

A standard dust- and water-tight push-button station for use in cement mills, coke plants, and the like is shown in the accompanying illustration. This control unit has silver contacts inclosed in a malleable iron box with a leather diaphragm between the buttons and the holes in the cover. In order to operate the switch, pressure is applied on the outside of the leather diaphragm.

Where it is necessary to have contacts immersed in oil to minimize the danger of explosions or to prevent corrosion of the copper contacts, the push-button stations bearing the designation BS-11-CL and BS-12-DK are offered. The first provides only a "Stop" button, while the second provides both "Start and Stop" buttons. These controls are especially designed to allow for easy removal of the tank for filling with oil.

A three-button station designated



General Electric Dust- and Water-Tight Push-Button Station

as BS-73 has been developed for light duty without plugging. This control is recommended for window opening service, valve control, dumb waiter operation and the like. Three forms are available with buttons marked Forward, Reverse, and Stop, with markings Raise, Lower, and Stop; and with markings Open, Close and Stop.

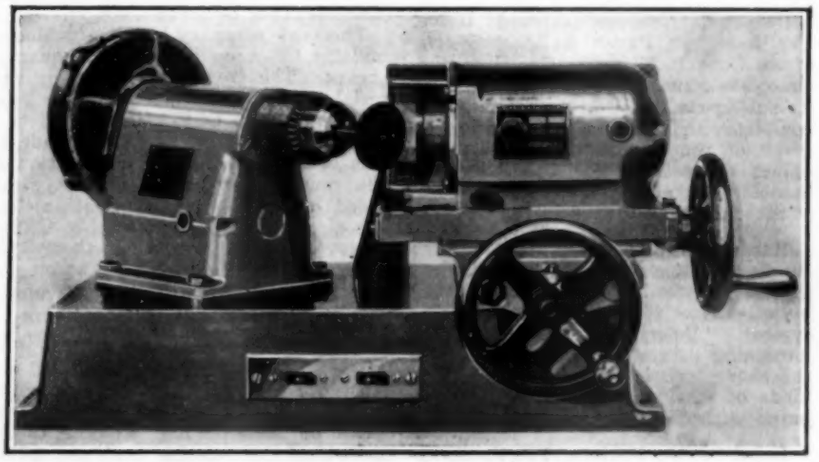
A push-button station provided with a protector indicating lamp is covered by types BS-11-DP, BS-12-HV, and BS-12-HW. Eighteen-volt, resistance-type lamps are used, instead of the bull's-eye, 115-volt type. Improved protection is obtained by the resistor which always limits the control current to a safe value for the contacts. The three types cover Stop, Start and Stop, and Fast and Slow markings and are standardized for 125 volts, although stations for any other standard voltage can be supplied.

An improved line of stations for back-of-panel mounting, where the front is to be flush with the front of the base has also been announced. Examples are the BS-11-DG "Stop" form and the BS-12-FR "Start and Stop" forms for use on any base between one and one and one-half inches thick. In mounting these stations, a cover can be removed after mounting in order that connections can be made.

Black & Decker No. 45 Electric Valve Re-facer

The Black & Decker Manufacturing Co., Towson, Maryland, have perfected a valve re-facer equipped with universal motors. One motor drives the work head; the other drives the grinding wheel. Both motors are of the universal type and can be operated on direct or alternating current of 25 to 60 cycles. Since all car, truck, and bus engines now have a valve angle of 45 deg., the work head of this electric re-facer is permanently set at this angle and hence cannot get out of adjustment.

The grinding head is mounted on



Black & Decker No. 45 Electric Valve Re-facer

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dove-tail slides with automatic spring take-up on the gibs to compensate for any wear. Automatic adjustment for wear is also provided on the chuck spindle, which is mounted in a taper bearing.

Standard equipment includes a diamond truing attachment. In this manner the stone is refaced at exactly the same angle as the valve so that a gas-tight fit of the valve in the piston head is assured. The equipment also includes a V-block attachment for grinding ends of valve stems; a special three-jaw refacer chuck, electric cable and attachment plug, and individual switches for the motors, which are built into the base.

Trade Catalogs

Electric Furnaces, High-Temperature. Automatic & Electric Furnaces, Ltd., 173 Farringdon Road, London, E.C. 1, England, has published section K on the Wild-Barfield high-temperature electric furnaces for the heat-treatment of high-speed steel and other materials at temperatures up to 1,400 deg. C. Two types of furnaces are described: One a complete production unit with pre-heating chamber, the other a single-chamber unit. Specifications are given in each case. The control apparatus is also described. The bulletin is well illustrated and contains eight 8½x11-in. pages.

Hammers, Drop. The American Punch & Shear Works of the Long & Allstatter Co., Hamilton, Ohio, has published bulletin No. BDH-A on its board drop hammers. Complete descriptions of the machines are given. The bulletin contains eight 8½x11-in. pages and is well illustrated.

Hammer, Rubber-Cushioned Helve. The American Punch & Shear Works of the Long & Allstatter Co., Hamilton, Ohio, has issued bulletin No. RCH-1 on its rubber-cushioned helve hammers. A complete and detailed description is given of the construction of this machine. Directions for operating the hammer are also given. The bulletin is illustrated.

Hardening Curves, "Volcrit." The Stanley P. Rockwell Co., 66 Trumbull Street, Hartford, Conn., has published bulletin No. 2610-B showing a few typical "Volcrit" expansion - time hardening curves. The curves indicate the characteristic expansion of various kinds of steel during heating as compared with "Volcrit" hardened steel.

Labor-Saving Devices. The Stephens-Adamson Manufacturing Co., Aurora, Ill., has published "The Labor Saver," No. 153, dated November, 1926. This magazine contains twenty-four 6x9-in. pages, and describes various installations of labor-saving equipment manufactured by this company. It is profusely illustrated with charts and photographs.

Motors, Small. The General Electric Co., Schenectady, N. Y., has issued an 8-page pamphlet entitled "Little Motors in Modern Business." In it is given a brief history of the electrification of office equipment and a discussion of the advantages obtained through motorizing calculating machines, tabulating equipment, typewriters, addressing machines, and the like. The booklet is illustrated with pen-and-ink sketches.

Milling Cutters. Goddard & Goddard Co., Detroit, Mich., has published its catalog C on milling cutters. The booklet contains 224, 5x7½-in. pages and is profusely illustrated with line cuts and halftones. It is bound with flexible cloth covers. The profile cutter section includes standard plain mills, alternate-tooth cutters, side and end mills, inserted-tooth straddle and face milling cutters, and metal slitting saws. Another section is devoted to special profile tools, appended to which is a description of the proper method of grinding such cutters. The form cutter section is devoted chiefly to involute gear cutters of various types. Thread milling hobs are treated in another section. Here again considerable space is devoted to the method of grinding such hobs. General instructions on milling are also given, including a table of cutting feeds and speeds.

Milling Operations. Kearney & Trecker Corporation, Milwaukee, Wis., has published a leaflet entitled Layout No. 21. It describes milling operations on automobile clutch cover plates. The leaflet is illustrated.

Punching and Shearing Machinery. The Long & Allstatter Co., American Punch & Shear Works, Hamilton, Ohio, has available for distribution reprints from its advertisement in the National Machine Tool Builders Catalog.

The same company has also published bulletin GS-A on its gate or squaring shears. The treatment is largely pictorial. Complete specifications are given. Bulletin CSP-A is devoted to a combination shear and punch made by this company. Detailed description of the construction of the unit is given, aided by a photograph. Specifications are also included. Bulletin No. GBS-A is devoted to guillotine bar shears, the constructional features of which are briefly described. Numerous photographs are included.

Welding Rod, "Weldite." The Chicago Steel & Wire Co., 103rd St. and Torrence Ave., Chicago, Ill., has issued a small bulletin entitled "A New Viewpoint on Metallic Arc Welding Costs" in which the relative cost per pound of weld for various grades of welding wire is discussed. The various types of "Weldite" rods are presented. A list of dealers is appended.

Wheels, Wrought Steel. Carnegie Steel Co., Pittsburgh, Pa., has published a 5x7½-in., 140-page pamphlet entitled "Wrought Steel Wheels and Other Circular Sections—Forged Steel Axles." Wrought steel wheels for various types of service such as freight car wheels, passenger car wheels, and locomotive tender wheels, etc., are listed in turn. For each particular type a brief description of its development and present characteristics is given, together with a cross-sectional view of the wheels to show its proportions with the aid of tabular information. In the section devoted to forged steel axles, a brief description of their manufacture is first given, followed by detailed specifications for each type and size. The remainder of the booklet is devoted to standard specifications for both wrought steel wheels and forged steel axles given by the American Railway Association and the American Society for Testing Materials, as well as this company's own standards.

Pamphlets Received

Foreign and Domestic Commerce, The Department of Commerce, Washington, D. C. has published the Annual Report of the Director (Julius Klein) of the Bureau of Foreign and Domestic Commerce for the fiscal year ending June 30, 1926. Copies may be obtained from the Superintendent of Documents, Government Printing Office, for $0.10.

Measurements of Length. The Bureau of Standards, Department of Commerce, announce the publication of Scientific Paper No. 535, entitled "A Fundamental Basis for Measurements of Length," by H. W. Bearge, Senior Physicist. The pamphlet may be obtained from the Government Printing Office, Washington, D. C. for five cents. In this pamphlet, the wave length of cadmium light is recommended as the fundamental standard of length. A simple relation between inches and millimeters is also proposed. A brief history of weights and measures of the United States and Great Britain is given in order to obtain a proper background for the establishment of a single basic standard. Evidence is put forth to prove the constancy of the wave length of cadmium light.

"Sharing Profits with Employees." The Policyholders' Service Bureau, Metropolitan Life Insurance Co., 1 Madison Ave., New York, has published report No. 91 under the above title. It contains sixteen 8½x11-in. pages, and it supersedes reports Nos. 47 and 51 on the same subject. Three plans are discussed: Sharing profits with all eligible employees, with employee stockholders, and with employees participating in a saving plan. The experiences of many companies are cited as examples.

News of the Week

Tax Reform Must Begin in City and State, Emery Tells Founders' Association

Reduction in present corporation tax is the first necessity

That a reduction in the income tax rate upon corporations would bring relief to more individuals than a reduction of the personal rate tax, was the statement made by James A. Emery, counsel for the National Founders' Association, in his address before the thirtieth annual convention of that body, in New York on Nov. 17. Mr. Emery, who is at present directing an effort sponsored by five large industrial groups to secure lower taxes and a reform in taxation methods, was the most important speaker at the convention and the problem of taxation was the most important that came before the assembly.

"The real taxation problem lies in the local community and in the state," said Mr. Emery, "and while the Federal Government is economizing and discussing tax reduction something must be done to eliminate the great local waste."

"TAX CONSCIOUSNESS"

This will be made possible to some extent through the formation of a committee in each state to help create "tax consciousness," the association members were told. Such committees, he said, should be named to distribute information concerning local indebtedness and expenditures and to awaken the public to the fact that "the decrease in the national debt and in Federal expenditures is being equalized in the much greater increase in state and local expenditures and in the state and local debt."

"The corporation tax on incomes for 1925 is 13 per cent, an increase of one-half of 1 per cent over the previous year, and the Government expects to collect 13½ per cent on incomes for 1926, in the face of today's figures showing the Treasury expects a $400,000,000 surplus for the present fiscal year." He advised repeal of the extra half of 1 per cent and the giving of future temporary relief through such decreases as the circumstances dictated.

Thomas E. Robertson Commissioner of Patents, told the association that his department at Washington was seriously handicapped because of cramped quarters and salaries insufficient to keep experienced examiners, and that such a condition was a drawback to industry.

The extended effort of the foundrymen in educational lines was brought out in an address made by L. A. Hartley, director of the industrial education department of the association. Mr. Hartley stressed the need for more accurate text books in the public schools and gave some illustrations of the false impression that the young student may gain from statements now included in popular school books on industrial economics. He took particular exception to a certain book in which the labor union was held up as the sole salvation of the working man in his fight for economic progress. He scored a certain type of educator and industrialist who appeared blind to the harmful results of the spreading of this kind of information among those not yet old enough to analyze the problem for themselves.

He also quoted statistics to show that the greater percentage of executives now controlling our industries were men who had no college education and he closed by charging the present generation of owners and managers with the task of planning the education of future executives. He stressed the need for more practical and efficient training courses for foremen and for apprentices.

Other speakers and their subjects at the convention were: "Practical Business Applications of Economic Studies," by M. C. Rorty, vice-president, the International Telephone and Telegraph Co.; "Natural Light and Ventilation in the Foundry," by Clarke P. Pond, vice-president, David Lupton's Sons Co.; and "Artificial Lighting in Foundries," by W. H. Rademacher, General Electric Co.

Facts About the Five-Year Air Program

Because Congress has adopted a five-year program for aviation in the Army and Navy many persons seem to think that this means that the program will be carried out, but the act merely authorizes the appropriation committee to bring in from year to year bills that will meet the program, and the Congress may or may not pay any attention to the authorization. This was brought out at the aeronautic meeting of the Society of Automotive Engineers in Philadelphia by Senator Hiram Bingham of Connecticut. The Treasury cannot spend a cent on the authority of an act that does not authorize an appropriation.

The people must not be led to suppose that because Congress authorized $100,000,000 to be appropriated for a five-year program there shall be in the Navy at the end of five years 1,000 useful airplanes and in the army 1,500 planes, more or less, of the same type.

Americans have become accustomed to thinking in terms of land transportation and have not learned to think in terms of air transportation, the Senator stated. A sea captain who is dependent upon the wind keeps away from a lee shore because if the wind fails he will be wrecked unless there is a safe harbor to get into. But in the air one is always within a couple of miles of a lee shore and if anything happens he must find a harbor. When people begin to realize that, they will realize the necessity for emergency landing fields. The Government must provide them, just as it provides breakwater and deepens harbors, and cities must learn to build their own airports.

Aviation may be expensive, but it is essential and worth while. If the public will become air wise in knowing what can and cannot be done in aviation and in getting to the point where it is willing to pay the expense of putting America first in the air, concluded Senator Bingham, we shall have something to look forward to that is worthy.

Prizes for Essay on Simplification

Because of the growing interest this year in the principle of "simplification," $550 in prizes are being awarded for the best article on "What Simplification Has Done for Our Business."

The contest is open to every one, especially writers and business men who have come in contact with business organizations using simplification. Consent of the organization about which the simplification article is written must, of course, be obtained before the article is entered in the competition.

The contest closes at mignight, Dec. 31, 1926. The judges of the contest are to be the members of the Planning Committee, Division of Simplified Practice, United States Department of Commerce, the governmental department which has been responsible for the encouragement of the use of "Simplification." They are: B. H. Ackles, president of the National Supply and Machinery Distributors' Association; W. L. Chandler, secretary of the National Association of Purchasing Agents; R. M. Hudson, chief of the Division of Simplified Practice, Department of Commerce; E. W. McCullough, manager of the Department of Manufacture, Chamber of Commerce of the United States; L. W. Wallace, executive secretary of the American Engineering Council; A. A. Stevenson, vice-president in charge of manufacture, Standard Steel Works; and Brig. Gen. H. C. Smither, chief co-ordinator, Bureau of the Budget.

Manuscript should be addressed to the Secretary, Simplification Awards, A. W. Shaw Co., Cass, Huron and Erie Sts., Chicago.

Economic Phases of Installment Buying Analyzed by Academy of Science

Problem involves real selling and the cost of financing sales

Installment buying in its various phases was the subject for keen and studious discussion at the forty-sixth annual meeting of the Academy of Political Science, held in the Hotel Astor, New York, on Nov. 17.

Installment selling in reality is as old as credit itself, stated Prof. Edward R. A. Seligman, who presided at the first session. He cited such examples as building and loan associations, government annuities and life insurance premiums.

"The modern development has, however, applied it to goods, wares and merchandise," he said. Even here, however, he draws a line between the old method of selling furniture, books, pianos and sewing machines with the newer application by makers of automobiles, radios, washing machines and the like.

Among the fundamental economic considerations are the character of the credit involved, the difference between consumer credit and producer credit. Does production mean the attainment of profits or the actual creation of commodities? Or the production of immaterial as well as material wealth? If we consider consumption according to whether the utilization of its product is productive or wasteful, we can better determine when installment buying is desirable.

Effect on Consumer

Another problem is the extent to which installment selling distorts or tends to rationalize the judgment of the consumer. It frequently leads to the purchase of unnecessary articles but, on the other hand, sometimes stimulates the individual to look ahead and plan his economic problem more intelligently. The effect on market conditions must also be considered and the cost of financing must be taken into account.

"Does installment selling increase production?" he asked. "In the paint business it has been a failure. In the automobile business it has been a notable success. The 10-payment plan in the clothing industry probably takes from one dealer what it gives to another. But in the case of washing machines or refrigerators, the economics of cost and energy may mean the ultimate growth of demand and therefore of production.

"The final problem is the effect on credit. So far as the individual risk is concerned, the problem is not essentially different from that involved in all credit. A little more care must be taken in the selection of risks. Again as to the effect of installment selling upon the up-swing of the business cycle, it must be remembered that while in a commercial crisis profits upon which ordinary loans depend cease while wages and salaries which form the mainstay of the installment business go on, at least in part. Frozen credits are not necessarily the concomitant of installment selling.

"Installment selling has undoubtedly come to stay. It has given rise to many abuses and to not a few dangers, but there is every likelihood that we shall find repeated here the history of credit in general. As in our existing banking structure we shall ultimately be able to distinguish between the sound and the unsound, the real and the specie; when the abuses are lopped off, installment selling will probably be recognized as constituting a significant contribution to the modern economic structure."

Among the other speakers was John E. Rovensky, of the Bank of America, on "The Relation of Installment Purchasing to the Credit Structure." He pointed out that temporary stimulation might easily arise but that a permanent increase depended on the extend to which we increase the productivity of the individual, either by bettering his living conditions or by putting him in a frame of mind that induces him to work steadier and harder. If stimulated production is only temporary, the result may be harmful in causing overproduction and the serious reaction that follows. This is evident when we consider that it is only by increasing the total income of society that we can permanently increase its total expenditures. There is no question to installment selling being here to stay—the problem is are we proceeding along the right lines?

"It is estimated that the total involved in installment sales is from seven to ten billions per year, with from 40 to 50 per cent of the sales outstanding at one time. With such a volume it becomes evident that we must consider the good of the whole country as well as that of the industries involved. Contracts will probably have to be standardized so as to protect the buyers' equity in the commodity in some cases where they now have no claim until the last payment is made."

Helpful Trade Associations

Prof. John Maurice Clark, in speaking on "The Effect of Competition on the Control of Trade Practices," pointed out the growth of trade associations and the good effect many of them had in improving trading methods. Unregulated competition is not an adequate safeguard for the purchaser, who is frequently not versed in business ways. The dangers are over-buying of things that cannot be afforded, contracts that are unequitable and false prosperity based on sales that are not completed. Among the advantages are the ability of the intelligent buyer to finance large purchases that come at considerable intervals without tying up liquid capital.

Speaking of installment purchasing, Lawson Purdy of the Charity Organization Society, pointed out its effect on families of small means and unsteady occupations. Unless the seller was wise, or humane enough to endeavor to prevent over-buying, the system worked hardship on the small buyer. On the other hand there were many cases where the ability to get needed clothing on credit was a great advantage to many people.

The general opinion seemed to be that installment buying involved many points such as the kind of customers, the kind of product, the method of sale, the method and cost of financing and the necessity for careful consideration of the future of both the seller and the purchaser. Generally speaking, it is felt that it is inadvisable to have installments continue beyond the life of the article sold; and that the savings due to large production are frequently exaggerated. The problem requires a better understanding of real selling and of the cost of financing such sales.

Industrial Activity Not Lessened by Lower Wholesale Prices

It has long been observed in the past that rising wholesale commodity prices have been accompanied or followed by heavier mercantile buying and increased production, while declining prices usually have been accompanied by lessened activity, states a report from the National Industrial Conference Board.

Since the beginning of 1925, however, this assumed economic relationship between prices and industrial activity has not held good in the United States, underlying economic factors in the meantime having undergone considerable change. Wholesale commodity prices since August, 1925, until October of the current year have shown a declining trend, yet the entire period from the beginning of 1925 until the present has been one of continued increase in industrial and commercial activity without parallel in the history of the country.

It must be remembered here, first, that the economic effect of hand-to-mouth buying tending to eliminate the necessity for the manufacturer of speculating in materials, and enabling him to maintain a high level of production with low inventories, has been not only to lessen the more violent fluctuations of commodity prices, but has otherwise altered the previously established behavior of prices in relation to industrial activity.

The increased purchasing power of wage earners' income, brought about largely by increased industrial efficiency, greater productivity per worker employed and resulting lower unit cost, as achieved in mass production, has been held responsible for much of the increase in business activity.

Volume of production during the first six months of 1926, according to the board, averaged about 28 per cent higher per month than in 1919, while the total value of production for the same period averaged only about 4 per cent higher than in 1919, clearly indicating that industry at present depends on volume rather than on price for an adequate profit. Wholesale commodity prices since 1923 have ranged from 22 to 30 per cent lower than they were in 1919, and from 29 to 36 per cent lower than they were in 1920.

While the mounting level of business activity thus is partially accounted for, a recent analysis of the business situa-

tion, taking into account the trend of consumers' cash income and savings as compared with total production, throws an altogether new light on the phenomenal increase in industrial activity during 1925 and 1926. Consumers' total cash income, as represented by total payrolls and farmers' earnings for the first six months of the current year averaged about 25 per cent lower per month than it did in 1919, while the value of total production averaged 4 per cent higher than in 1919. The total value of goods distributed through the retail trade averaged nearly 25 per cent higher during the first six months of the current year than it did during 1919.

While the conference board analysis leaves no doubt that more goods are being produced and enjoyed because of greater productive efficiency and lower prices, the fact remains that the total value of goods produced and sold, even at the lower price level, in dollars and cents shows an increase over 1919, while the consumers' total cash income shows considerable decrease. The riddle of how, in dollars and cents, more can be bought with less cash income, and how at the same time new savings can increase, in the light of the conference board's analysis, raises a problem the solution of which may be found largely in the steadily increasing amount of instalment buying and in economies effected in distribution and credit methods.

Booklet Ready on Iron and Steel Scrap

Simplified Practice Recommendation No. 58, covering the classification of iron and steel scrap, is now ready for distribution through the Department of Commerce. The recommendation, in booklet form, has been issued under the immediate direction of the Bureau of Standards and has the approval of the National Committee on Metals Utilization. This committee is a group representative of twenty-one trade and technical associations, labor bodies and manufacturers organizations.

In the preface it is pointed out to the reader that the program described therein offers a means for eliminating much waste through the co-operation of individuals and organizations in adhering to the classifications listed. Copies may be purchased from the Superintendent of Documents, Government Printing Office, Washington, for ten cents.

Airplane Engines For Sale

The Chief of Air Corps has for sale a number of airplane engines. The engines can be sold only for flying purposes within the territorial limits of the United States.

These are new "Liberty" engines, 12 cylinders, 400 hp. and are in storage at the Little Rock Air Intermediate Depot, Little Rock, Ark. The price free on board cars or trucks at Little Rock is $2,000, each, plus a handling charge of $10. Further information may be obtained from the Chief, Material Division, Air Corps, McCook Field, Dayton, Ohio.

Reviews Progress of the Federal Air Policy

A review of the progress being made in the development of the Government's air policy is contained in a recent report made by William P. MacCracken, Jr., Assistant Secretary of Commerce for Aeronautics. This report covers the organizing of the department's air program and traces the progress being made in the formation of a definite air program to include both commercial and air mail units.

The department is charged with the duty of registering eligible aircraft, certifying to their air worthiness, examining the operating personnel and air navigation facilities, also of establishing air traffic rules. It is authorized to lay out airways, provide for lighting, mapping, and emergency landing fields and in other directions furnishing assistance to aviators such as radio-direction fog-protection facilities, weather information, and other aids to navigation.

The purpose of the Government has been threefold—first, to secure better development of this new form of transportation for commercial purposes; second, to create private commercial services which can relieve the post office of its direct expenditure upon air mail; and third, by the creation of a large commercial air fleet with its accompanying personnel and its background of the manufacturing industry to give a fundamental military reserve to the country.

On Jan. 1, 1926, there were 369 miles of air transport services in operation by private enterprises, and there were 2,665 miles operated by the Post Office Department. Assurance of congressional action and the official passage of the act have resulted in considerable preparatory activities by private enterprise. Little commercial aviation could be organized until the fundamental services above mentioned were assured, as no commercial concern could undertake to provide these aids to navigation at its individual expense, not only because of the large preliminary outlay but because such facilities would be equally available to competitors.

The work of the department in development of the new aviation division has during the past fiscal year been of preparatory order like that in the industry. It may be said, however, that already commercial operations have been undertaken in reliance on the provisions of the air commerce act in a number of directions, and it seems certain that the Post Office Department will be able to let contracts which will relieve it of all transportation of the air mail during the present fiscal year.

Engineers Report Survey on Farm Equipment

Meeting on Nov. 17 and 18 in Washington at the call of Secretary Jardine, some of the country's leaders in engineering as applied to the mechanical equipment of the farm devoted their attention to reviewing and giving effect to the results of the year's work carried on by Prof. J. Brownlee Davidson, of Iowa State College, whom the department secured to direct a survey on farm equipment research.

The Department of Agriculture took up this project at the urgent request of a joint committee representing the National Association of Farm Equipment Manufacturers and the American Society of Agriculaural Engineers, and in recognition of the important part that mechanical equipment plays in American agriculture. These organizations are committed to the idea that well organized research is indispensable to continued advance in the design and use of labor-saving machinery on the farm.

The survey has as its specific object the working out of a co-ordinated program which should serve all agencies—whether Federal, State or commercial—as a foundation for research in mechanical farm equipment.

New Shop System of Tolerances

The meeting of the Detroit section of the American Society of Mechanical Engineers, held on Nov. 17, was well attended.

W. L. Hindman, a member of the engineering staff of Dodge Brothers, told of the development of a new system of tolerances for governing machine shop practice. His paper described this system.

John Gaillard, engineer of the Engineering Standards Committee, of Washington, D. C., presented a written discussion covering the opining of the committee regarding the new system.

The meeting was held at the Detroit Engineering society clubhouse.

S.A.E. Tractor Meeting With Agriculturists

Some of the topics and speakers on the program for the annual tractor meeting of the Society of Automotive Engineers, to be held in Chicago Dec. 1 to 3, in co-operation with the American Society of Agricultural Engineers, have been announced.

T. W. Allen, of the U. S. Bureau of Public Roads, is to tell of the use of tractors and automotive equipment in the building and maintenance of roads. The application of tractors to industrial purposes will be described by William Parrish, of the International Harvester Co. How heavy fuels are used in tractors will be told by S. M. Udale, of the Holley Carburetor Co., and Ralph H. Sherry, metallurgist and industrial engineer, is to talk on design and manufacturing factors in metalliferous materials.

Other speakers will be: F. A. Wirt, of the J. I. Case Threshing Machine Co.; C. D. Kinsman, U. S. Department of Agriculture; C. O. Aspenwall, International Harvester Co.; T. D. Campbell, president, Campbell Farming Corporation; F. N. G. Kranich, Timken Roller Bearing Co.; and several prominent teachers from leading agricultural colleges.

A meeting committee is arranging to have special addresses given at informal luncheons and dinners to be held between and after sessions.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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IN THEORY price stability is regarded as desirable, but when it is achieved it often becomes irksome. The explanation is that change is exciting and sometimes stimulating, even though it may be costly, whereas what is called a "steady" market offers no opportunity of the aleatory instinct and soon gets to be monotonous. Therefore "dull" succeeds "steady" just as "easy" follows "dull" and "weak" comes after "easy" in the descriptive terminology of the market place.

Just now it is questionable whether American business will follow this conventional sequence. In so far as statistics are concerned it must be admitted that they do not sustain the reactionists. The figures of our foreign trade for October which show an excess of exports over imports valued at $74,000,000, are particularly impressive, but railroad earnings, car loadings, chain store sales, life insurance writings, savings bank deposits and nearly all the other indicia of business and expenditure tell the same story. For example, it is estimated that more than $75,000,000 will be spent by the thousands of Americans who are booked for the various de luxe tours to foreign lands that are now being advertised by many steamship companies.

Meantime, we continue to lend enormous sums abroad and even the churches of Europe, both Protestant and Catholic, have recently sold large bond issues that were publicly offered and eagerly taken in the United States.

Through the purchase of these obligations we are selling our exportable surplus upon credits granted to foreigners, and an increasing share of our domestic trade is also based upon the credits allowed to the millions of installment buyers who have pledged their future earnings to pay for the luxuries or non-essentials that have taken their fancy.

The whole business structure—national and international—has in fact become dependent upon credit to a degree that is without precedent in this or any other country, and while this is all right as long as the earning power of the debtors is unimpaired, it may become a menace if anything that is seriously untoward happens. For this reason the maintenance of the present price level is exceedingly important and its tendency should be closely watched.

Thus far the recent decline in cotton and the weakness that wheat, corn and hogs showed last week are the only definitely adverse price movements that are to be noted. They cannot be properly regarded as symptomatic of any general depression, but for political reasons their significance may be misinterpreted, and from what was said at a meeting of the farm leaders held in St. Louis last week it seems almost certain that Congress will be insistently urged to adopt some radical measures for the relief of the farmers.

At the meeting referred to eleven grain and six cotton states were represented and the coalition of the agricultural West and South so effected, is too powerful to be ignored.

That the farmer is and has been at a great disadvantage under our present economic system is undeniable, and that something must now be done for his protection is generally admitted. But the trouble is that some of the farmers' friends insist that his protection means less protection for the manufacturers who supply his needs and that the rival claims of each group have created a political impassé from which egress is difficult.

Therefore, it is not too much to say that the immediate future of business in the United States is largely dependent upon the tact and economic discernment with which the agrarian issue is met. If it can be satisfactorily disposed of, we ought to have stability and prosperity for as far ahead as it is safe to look, but if it is fumbled, the reactionists may be vindicated.

Of the stock and commodity markets other than those already mentioned it is hardly necessary to speak in detail. On the stock exchange traders are waiting for some cue from Washington, while the speculators who are long are commencing to wonder why the market does not advance.

The conspicuously frequent announcements of extra and increased dividends that are being made emphasize our industrial prosperity and we are also enjoying low money rates considering the high rate of business activity. The weekly statements of the Federal Reserve Banks reveal so little recourse to the reserves of credit maintained by the system that fear of higher money rates is no longer felt and some look for a decline, at least after the holidays.

Industry is relatively quiet. Both the automobile and the iron and steel makers are lapsing into the normal year-end recession but their curtailment is not to be seriously regarded because they will be all the more active for it after the turn of the year.

Rubber is one of the most interesting of the commodity markets because of the tug of war that is going on between plentiful present supplies and the possibility of later scarcity.

The news from Europe is cheerful. A settlement of the British coal strike seems to be really impending and a widespread revival of trade throughout the Empire is predicted. Declining coal prices and somewhat lower ocean freight rates should follow.

Taken altogether the outlook is reassuring and the politico-economic questions that require attention in America are about the only questions with which American business need concern itself.

What's Doing in Industry

Little change from last week is reported by manufacturers and dealers in the machine tool and machinery industries. With the anticipated suspension of high production activities in the automotive industry, the Mid-West is experiencing a decided slackening in machinery sales.

Inquiries have fallen off, but this is a seasonal condition. Salesmen report that business today must be sought after more intensively, and that competition makes the contest more keen.

Cincinnati reports a satisfactory condition, with business holding up and prospects good. The improvement reported from Chicago a few weeks ago is being maintained and more than one large list is expected to close soon. Sales in Cleveland have slacked off, only replacement business being received. Lessened activity in large automotive plants is being felt in Detroit where only orders for much needed equipment are being placed. In Milwaukee business is said to be equal to what it was last year at this time.

New York dealers report enough business to be had by those who go after it, but inquiries have fallen off noticeably. A satisfactory condition prevails in New England with good outlook for a few months, at least. Conditions in Philadelphia are spotty, but some good railroad purchasing is pending.

Taken altogether, the general business outlook is reassuring and the politico-economic questions that require attention in America are about the only questions with which American business need concern itself.

The Industrial Review

Progress of the machinery and machine tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Philadelphia

A survey of the machinery and machine tool business in Philadelphia last week showed a somewhat spotty condition. Some of the larger dealers and producers report a satisfactory situation, while others report a falling off in orders and inquiries.

The report that the Pennsylvania R.R. is about to enter the market for seventy-five new passenger locomotives, and that a large number of freight engines is contemplated in the company's shops at Altoona, Pa., was an interesting development. Machine tool producers are informed that both the Baldwin and the American Locomotive Works are estimating on this prospective purchase.

From other sources Philadelphia machine tool producers believe that the steam railroads soon are to enter the field for extensive tool purchases. This information is based largely upon inquiries coming from roads over a well scattered area.

Producers of balancing and testing machines who have enjoyed an active season, reported some rather extensive purchases from the automotive trade, and from iron and steel industries. Manufacturers of leather belting machinery, who are in touch with nearly all sorts of industries, report a good business, with prospects of continued buying during the remainder of the year.

Manufacturers of steel casements and steel shelving, who produce equipment for all kinds of factories and industries generally, report a good business.

New York

Dealers and agents in this market are finding it to be a case of going after what business there is to be had at the present time. Inquiries have dropped off and it is generally believed that no new lists will be issued by large buyers until after the first of the year. Appropriations for machinery and shop equipment have been used up and little business is expected from these sources until additional funds have been provided.

There has been some buying done in the past week, but most of it has been for replacement of worn out or obsolete tools. One or two fair sized orders were received, notably one for 10 lathes from the Waltham Watch Co., and one for 4 automatic milling machines from the Scintilla Magneto Co. Other buyers of tools were the International Harvester Co., the Royal Typewriter Co., the Kelvinator Corporation, the Brewer-Titchner Co. and the Quality Machine Co. The Long Island R.R. placed an order for a large crane, and the New York Central R.R. bought one or two machines on old quotations.

Detroit

Further decline in sales of machinery and machine tools in Detroit and other automotive centers in southwestern Michigan is reported by a number of local dealers. The seasonal slump which manufacturers anticipate for this period of the year appears to have started earlier than usual. Many believe that there will be no material improvement in market conditions until automobile show time.

As contrasted with the inactivity of some plants, several Detroit manufacturing establishments are buying quite extensively. The new electrical refrigeration plant of Kelvinator and Nizer, now under construction, will call for several hundred thousand dollars worth of machinery. One firm reports the sale of more than six automatic screw machines. At the Kelsey Wheel plant some heavy-duty drilling machines have just been installed.

Several milling machines, 9 hobbing machines and a few grinders have been ordered by Cadillac for the new smaller "eight" which is expected to be announced to the public in January. Four special spline grinding machines have been purchased by Packard, as well as some cylinder head profiling machines. The Continental Motors Corporation is tooling up for an order of some 30,000 six-cylinder motors which the manufacturer of one of the popular lines of four-cylinder cars expects to announce within the next two or three months. Continental is buying some boring equipment for cylinder blocks also.

Some replacements are being made at the Studebaker plant but all these are single machines, as it appears to be the Studebaker policy to purchase for the Detroit plant only such equipment as is actually needed, pending the eventual removal of all Studebaker manufacturing activities to South Bend.

Chicago

The improved condition of the machinery market experienced during the first two weeks in November is being fairly well maintained. With an exception here and there, dealers report business, if not quite as active as it has recently been, to be satisfactory, the time of year considered.

Inquiries continue to be received for machine tools, but chiefly with reference to future delivery, and not definite as to date. The expectation that the two major lists in the hands of the trade would have been closed before this date has not been realized up to this writing, and the matter of closing, from all accounts, is no nearer than it was two weeks ago. The lists referred to are those of the Illinois Steel Co. and the Pullman Car and Manufacturing Co.

Used tools are in fairly good demand. In wood-working machinery there has been a slight falling off as compared with October business. There has been some talk of an advance in prices on standard tools of heavy-duty type, but inquiry has failed to substantiate the rumor.

Business for the remainder of November is not expected to show any appreciable increase, but if maintained at its present plane dealers say they will have no reasonable cause for dissatisfaction. Trade in electrical tools continues on the same good level that has characterized it for the last several months.

Milwaukee

Comment respecting new business in metal working equipment continues to bear an optimistic tone, and while there have been months this year which produced a larger volume of orders, November is confidently expected to pass with a mark fully equal to that of the same month a year ago. December should be as satisfactory, making a year comparable to the best in the last four or five.

In the automobile industry, shops are looking for equipment for immediate replacements, made convenient by the seasonal slackening of passenger car production, which this year set in fully a month to six weeks later than last year. Specifications also are beginning to come to tool shops for production machines that will be needed when output schedules again swing upward in January and February. Every effort is being put forth to promote production economy by changes and additions to existing tooling, or by replacing older types with more efficient machines on quantity work.

New England

Machinery builders in New England turn into the last month of the year entertaining feelings of satisfaction and with anticipation that business will continue active for some months ahead. The seasonal depression of the automotive industry is reflecting itself in some quarters, but the general concensus is that the condition will be short-lived. In Bristol, Conn., where there is much direct automotive production, a lull prevails, but in the neighboring city of New Britain operations continue at an active pace with no sign of let-up.

Hartford factories are normally active with a heavy volume of business among special machinery builders. Business in New Haven and Bridgeport is well maintained. No signs of lessening of production appear in Springfield, Chicopee or Worcester.

With the approach of the end of the year executive heads who have studied the company statements are gratified to observe an improvement in the financial position and 1926 profits, generally speaking, are greatly improved over 1925.

Cleveland

After several months of steady, active business the local machinery and machine tool market has struck a slump. Buying for the past fortnight has been slow and spotty. The orders booked were mostly for single pieces for replacement. This condition was not unwholly unexpected and it is thought to be the forerunner of a seasonal readjustment which is expected to last until January.

The recent decrease in business has reverted to a buyers' market with prospective purchasers in some instances demanding price reductions and longer terms of payment.

Production is up to capacity and new orders for special tools are scheduled for delivery after February first.

The used machinery market is active with a noticeable shortage of the better class of tools.

Cincinnati

Practically all Cincinnati machine tool manufacturers report business conditions as satisfactory in the past week. A majority of the concerns report a fair increase in demand and none report a falling off.

There is considerable speculation as to what will be the direct and indirect influence of the settlement of the British coal strike, and the consequent lowering of the prices of fuel in this country. In the opinion of some, the lowering of the prices of coal will benefit the machine tool industry in a direct way, through reducing manufacturing expense. Others are of the opinion that this will be more than offset by the fact that profits of the operators will be reduced to the point where they cannot afford to buy machine tools or other equipment. Still another opinion is that the operators have been so busy that they could not make needed improvements, and they will buy just as soon as the mines have a lull.

It is unofficially stated that a very large order from the Gary plant of the U. S. Steel Corporation is about to be given out, this calling for seventeen big lathes and a number of other tools. Concerns in the automotive industries confined their buying to single tools and replacements, and the same was the case with the railroads.

Buffalo

While November business among machine tool and shop equipment dealers of Buffalo has developed in such a way that there is still considerable to be desired, it is not too early to say that the close of the month will probably show a greater volume than October.

The upturn of business in November is not expected to develop into anything startling and in many cases the inquiries have to do with projected purchases after New Year's. Inquiries are more brisk than in some months, and with most dealers it is expected that December will close as one of the good months of the year.

The demand for electrical equipment is about on a par with that of other shop equipment. Earlier in the year it led the demand but that has not been the case during the last two months and will not be the case this month. The demand for contractors' equipment is slow. There is no railroad buying.

Welding Included in Engineering Curricula at Leading Technical Colleges

Teachers tell American Welding Society of courses

Engineering students are being given fundamental instruction in the welding art at most technical schools and colleges. This was the message brought by five professors of mechanical engineering to the members of the American Welding Society at their fall meeting in Buffalo, Nov. 16 to 19. Other features on the program were papers on structural welding, railroad shop welding and arc welding in a hydrogen atmosphere. Coincident with the technical meetings the largest exhibit of welding equipment ever assembled was in progress at the Broadway Auditorium.

Prof. T. S. Hart of the department of mechanical engineering, Syracuse University, reported on an investigation of the extent to which welding is taught, made at the request of the American Welding Society. He sent a questionnaire to 100 schools and colleges and found that 30 per cent use electric welding apparatus, 60 per cent gas apparatus and 10 per cent Thermit apparatus. Half give lectures on welding and in nearly half the students have some welding practice. Other papers on the same topic were presented in person by Prof. O. R. Rickly of Ohio State University and Prof. F. V. Larkin of Lehigh. The secretary read papers by Prof. W. P. Turner, of Purdue, and Prof. E. L. Lucas of Mississippi A. and M.

At the session on railroad welding papers were presented by M. Gjersten, master welder, Northern Pacific Co., and F. H. Williams, assistant test engineer, Canadian National Railways. Mr. Gjersten described the various major welding operations encountered in the railroad repair shop and gave a list in which the type of welding most suited to each was mentioned. He also gave a number of cost figures to show the savings made possible by welding.

Mr. Williams spoke on the organization of welding on the railroad and included as appendices to his paper excerpts from the Manual of Electric Welding and Metal Heating prepared by the Welding Committee of the Association of Railway Electrical Engineers, a list of economics effected by welding, maintenance regulations for oxy-acetylene welding and cutting, and specifications for electric welding electrodes.

A session was devoted to further consideration of the Linde and Westinghouse tests on gas and electric welded structural members. H. H. Moss of the Linde Air Products Co. summarized the results of comparative tests on gas welded and riveted trusses of similar design. The results proved that the welded truss is somewhat stronger than the riveted one and indicated that still greater strength is possible if the design be modified to take full advantage of the welded joint. Some economy in bracing members also seems probable. The cost of the welded truss is approximately equal to that of the riveted one.

A. M. Candy, welding engineer of the Westinghouse Electric and Manufacturing Co., analyzed the results of tests conducted on structural column connections at the Carnegie Institute of Technology early in the summer. Some of his conclusions were:

That welded joints can be constructed in such manner as to develop fully the ultimate strength of the structural members connected.

That lines of beams or girders can be connected so as to provide complete continuity across the supports, whether the supports be girders or columns.

That a steel I-beam of given section and length will sustain a far greater load if fixed at its ends by a suitably designed welded joint than if supported by standard riveted connections consisting of top and bottom angles.

That a plate girder assembled by welding and consisting of nothing but sheared plates, has a far greater bending strength than a riveted plate-and-angle girder of the same weight, due to the better distribution of the steel in the cross-section.

That in a welded building it will be possible to make every joint develop full strength of the main members, whereas in a riveted building many joints are weaker than the members due to the weakening effects of the rivet holes and the weakness of steel angles which have to be used for transmitting tension between two members at right angles to each other.

Further information on the research being done by the General Electric Co. on arc welding in the presence of atomic hydrogen was given by R. A. Weinman of that company and also by Dr. Alexander. Much work has been done recently on all of the common metals and many alloys, notably the harder alloy steels. Three hand torches have been developed in different sizes with the object of utilizing current ranges from 3 to 300 amps. They have been applied to thicknesses of metal from 0.005 to 2 in. thick, the fusion in each case penetrating the entire thickness of metal. While the laboratory results have been extremely interesting it will be some months before commercial apparatus will be ready for sale.

The exhibit of welding equipment was much larger than the previous one and more interesting. The following firms were represented:

Allan Manufacturing & Welding Co.; Air Reduction Sales Co.; Alloy Welding Processes, Ltd.; American Brass Co.; Acheson Graphite Co.; Beals, McCarthy & Rogers; Bearium Bearings, Inc.; Buffalo Forge Co.; Burke Electric Co.; Buffalo Gasoline Motor Co.

Carbic Manufacturing Co.; Elkon Works; Endress Manufacturing Co.; Electric Arc Cutting and Welding Co.; Federal Machine & Welder Co.; J. E. Ferguson Co.; General Electric Co.; Gibb Welding Machines Co.

King Refractories Co.; Liquid Air Limited; Metal & Thermit Corporation; Alexander Milburn Co.; Niagara Falls Power Co.; Northwestern Manufacturing Co.; Oxweld Acetylene Co. and associates; Page Steel & Wire Co.; Purox Co.; John A. Roebling's Sons Co.; Root, Neal & Co.

Shawinigan Products Co.; Sherwood Manufacturing Co.; Swift Electric Welder Co.; Torchweld Equipment Co.; Thomson Electric Welder Co.; Transportation Engineering Co.; U. S. Light & Heat Corporation; Una Welding & Bonding Co.; Westinghouse Electric & Manufacturing Co.; Wickwire-Spencer Steel Co.; Willson Goggles, Inc.

W. H. Eager Heads New W.B.-Detroit Merger

Officers and directors of the new Whitman Barnes-Detroit Corporation, formed in September, as the result of the merger of the Whitman & Barnes Manufacturing Co., of Akron, and the Detroit Twist Drill Co., of Detroit, are announced by William H. Eager, president of the organization.

In addition to Mr. Eager, former Whitman & Barnes president, are Muir B. Snow, vice-president, and Karl Kendig, secretary and treasurer. Other directors are A. H. Commins, of Commins, Brouse, Englebeck & MacDowell, Akron; W. J. O'Neill, vice-president of the Union Trust Co., Cleveland; A. D. Armitage, chairman of the board, J. H. Williams Co., Buffalo; C. H. Hecker, vice-president of the Detroit Lumber Co.; H. H. Sanger, vice-president of the National Bank of Commerce, Detroit, and J. H. Hamblen, Jr. of Warren, Cady, Hill & Hamblen, of Detroit.

Mr. Snow was president of the Detroit Twist Drill Co. Mr. Kendig was secretary and assistant treasurer of Whitman & Barnes. H. Z. Callender, Whitman & Barnes' sales manager, becomes sales manager of the new company. Ralph Hammersley, formerly superintendent of the Whitman & Barnes works is to be chief engineer of the corporation, and J. A. Dietrich, superintendent of the Detroit Twist Drill Co., continues as superintendent of the new organization.

Plants operated by both companies prior to the merger are to be maintained for the present. Gradually, as expanded facilities in Detroit permit, the Akron factory activity and personnel will be moved to Detroit, according to plans. The executive offices have already been centered in Detroit.

Warehouses and branches maintained by Whitman & Barnes in New York and Chicago will be continued.

Gage Steel Meeting

Announcement is made of a meeting on Dec. 6 of the gage steel committee which is working independently with the Bureau of Standards of the Department of Commerce. This meeting will be held in the morning in the Engineering Societies Bldg., New York, and will take up three main subjecs: Dimensional changes on hardening, artificial aging, and wear test. Members of the committee and other interested in this work are invited to attend.

Personals

A. E. MARTELL has been appointed sales manager for Maris Bros., Inc., of Philadelphia, manufacturers of hoists and cranes.

H. O. SMITH has been appointed chief of the Automotive Division of the Department of Commerce.

H. K. BRIGGS has been appointed assistant secretary of the American Society for Steel Treating. He is a metallurgist for the Minneapolis Electric Steel and Castings Co.

THOMAS J. LITLE, until recently chief engineer of the Lincoln Motor Car Co., has been appointed chief engineer of the Marmon Motor Car Co., of Indianapolis.

K. L. CLARK, formerly with Henry Disston & Sons, of Philadelphia, is now associated with the Kinite Corporation, of Milwaukee.

C. W. LAUGHLIN has been appointed sales manager for the J. S. Miller Machinery Co., of Pittsburgh. He was formerly associated as a partner in the Laughlin-Barney Machinery Co.

A. J. GERLACH has been appointed advertising and sales promotion manager of the Sterling Motor Truck Co., of Milwaukee. He was formerly advertising manager of the Keerney & Trecker Corporation.

GREGORY J. COMSTOCK, formerly metallurgist of the International Silver Co., Meriden, Conn., has been appointed director of research of the Firth-Sterling Steel Co., McKeesport, Pa

BURTON L. DELACK, assistant manager of the Erie, Pa., works of the General Electric Co., has been appointed assistant manager of the Schenectady, N. Y., works. John St. Lawrence, general superintendent at Erie, has been named to succeed Mr. Delack there.

OWEN K. PARMITER has been appointed metallurgical and sales engineer of the Firth-Sterling Steel Co., McKeesport, Pa. Mr. Parmiter has been alloy and tool steel chemist with the Firth-Sterling Steel Co. for 3 years and also assistant metallurgist. In 1918, he was appointed metallurgist in charge of all technical operations.

SIR WILLIAM LETTS, managing director of the Crossley Motors, Ltd., London, England, arrived in the United States on Nov. 17. He will spend a part of his time in this country conferring with John N. Willys, president of the Willys-Overland Co. Sir William is president of the British subsidiary of that company.

ERICH KRAMER, president of the Berliner-Kugelager-Abrick Co., of Berlin, Germany, manufacturer of ball bearings, accompanied by Leo L. Lowry, president of the Riede Ball Bearing Co., of New York, is making an industrial and labor survey in Indianapolis with a view of moving the Berlin factory to Indianapolis or some other Mid-Western city.

Obituaries

ELWOOD J. JUNKIN, president and secretary of the Advance Aircraft Co., died at his home in Troy, Ohio, on Nov. 6. He organized this company four years ago to manufacture commercial airplanes.

THOMAS E. VAUGHN, for many years sales representative in Pittsburgh for Manning, Maxwell & Moore, Inc., and more recently associated with the Pittsburgh Gear and Machine Co., died at his home in that city on Nov. 8.

THOMAS J. NEACY, president of the Beaver Manufacturing Co., of Milwaukee, manufacturer of gasoline engines, and for many years president of the Filer & Stowell Co., manufacturer of sawmill and lumber manufacturing equipment, steam engines, etc., died on Nov. 16.

CHARLES S. COOK, vice-president and treasurer of the Kaestner & Hecht Elevator Co., died in Pittsburgh, on Nov. 15. Mr. Cook, who was formerly associated with the Westinghouse Electric and Manufacturing Co., and the Duquesne Light Co., was widely known in the electrical manufacturing business.

G. A. SACCHI, manager of the stoker sales department of the Westinghouse Electric and Manufacturing Co., died suddenly on Nov. 4 at his home in Lansdowne, Pa. Mr. Sacchi became associated with the Westinghouse company in 1893, with Westinghouse, Church, Kerr & Co., which then represented the selling organization of the Westinghouse Machine Co. In 1909 Mr. Sacchi became actively engaged in the sale of stokers in the New York territory, and subsequently became manager of stoker sales for the entire company.

Business Items

Niles-Bement-Pond have moved their Boston office to 75 Batterymarch St. Marcus Chase is manager of this branch.

The Black & Penn Machinery Co. has been incorporated at San Diego, Cal. The incorporators are George V. Black, Walter G. Penn and W. A. Corder.

The Youngstown Foundry and Machine Co., of Youngstown, Ohio, has acquired part of the foundry property of the United Engineering and Foundry Co., at Pittsburgh, and will remodel it for a new plant.

The American Heat-Treating Co., of Philadelphia, has acquired the plant of the McHatton Foundry Co., in that city and will establish a shop there.

The Parker Motor Truck Co., of Milwaukee, has been organized from the old Parker Motor Truck Service Co., and will manufacture trucks. J. Grossman is now in charge of the affairs of the new company.

The Wilboken Manufacturing Co., 404-406 Grove St., Milwaukee, manufacturer of electric controlling devices, has acquired a site adjoining its present plant and additions will be undertaken in the spring.

The Millespaugh & Irish Corporation, of Indianapolis, has completed plans for the opening in Detroit, of a new automobile body building plant. The shop will occupy the old site of Graham Bros., in Detroit.

The P. I. V. Gear Syndicate, Ltd., of 7 Princes St., Westminster, S. W. 1, London, England, manufacturer of the "positive infinitely variable" gear, will establish an American branch of the company to manufacture and sell its products.

Details have been completed for the merger of the Aetna Foundry and Machine Co., of Warren, Ohio, and the Standard Engineering Co., of Ellwood City, Pa. The new organization will be known as the Aetna-Standard Engineering Co.

Articles of incorporation have been filed with the secretary of state in Indianapolis by the Auburn Stoker Corporation, of Auburn, Ind. The corporation will deal in powerhouse and boiler room equipment. The incorporators are R. O. Fink, John Fulton, A. L. Murray, Charles E. Kingsbury and Herschel E. Fitch.

The Hartford Steel Ball Co., of Hartford, Conn., has been organized and incorporated in Connecticut and has taken over the business heretofore conducted by Charles H. Abbott, Inc. A new factory has been established at 609 Franklin Ave., in Hartford, and the manufacture of steel balls for bearings, and metallic burnishing materials, is progressing. Charles H. Abbott is president and general manager.

It was announced in Toledo on Nov. 17 that the Wayne Motor Car Co., of Detroit, had been organized and would manufacture a new Knight-motored six-cylinder automobile of moderate price. John A. Nichols, Jr., for many years with Dodge Brothers Co., will be president of the company. R. N. Harger and R. H. Allen, formerly of the Dodge organization, and D. R. Wilson, of the Wilson Foundry and Machine Co., are other associates in the venture.

The Perkins Machine and Gear Co. has been formed in Springfield, Mass., as successor to the Perkins Appliance Co. Heads of the Chapman Valve Manufacturing Co. hold an interest in the new concern, of which Julian L. Perkins will be president, Adolph W. Gilbert, chairman of the board of directors, and James J. Duggan treasurer. John Oakley will be vice-president in charge of production and James A. Perkins will be in charge of sales. The concern expects to increase its production of small gears for washing machines and other domestic appliances.

Calendar of Local Meetings

Society of Automotive Engineers

Cleveland Section. Nov. 29. "The Engineer, the Trade and the Owner," by David Beecroft.

National Association of Cost Accountants

Boston Chapter. Dec. 16. "Plans for the Taking of Physical Inventories," by Stanley G. H. Fitch.

Buffalo Chapter. Dec. 16. "Inventories," by Lewis D. Crusoe.

Cleveland Chapter. Dec. 15. "The Budget as a Business Compass," and discussion of Question Box topics.

Detroit Chapter. Dec. 16. "Hidden Costs in Industry," by C. A. Hoskins.

Erie Chapter. Dec. 20. Budgetary Control and Predetermined Standard Cost.

Hartford Chapter. Dec. 21. "Visualizing Costs," by Carl F. Dietz.

Hawaii Chapter. Dec. 28. "Process of Starch Extraction from Canna Root," by W. L. Doty.

Kansas City Chapter. Dec. 20. How to Read a Balance Sheet and Operating Statement.

Los Angeles Chapter. Dec. 21. Department Store Accounting and Special Christmas Stunts.

Milwaukee Chapter. Dec. 16. "Standard Costs: Scrap and Special Materials," by W. B. Castenholz.

Philadelphia Chapter. Dec. 17. Inventory Control for Manufacturing Industries.

Pittsburgh Chapter. Dec. 15. Joint meeting with Pennsylvania Institute of C. P. A.'s. Speaker: A. L. Ashley.

Providence Chapter. Dec. 13. "Inventories," by W. G. Roelker, W. C. Lane and H. E. Howell.

St. Louis Chapter. Dec. 21. "Costs in the Milling Industry," by W. C. Bechert.

Rochester Chapter. Dec. 15. "The Balance Sheet," by David C. Barry.

San Francisco Chapter. Dec. 27. Preparation for Inventory.

Springfield Chapter. Dec. 15. "Federal Income Taxes on Corporations," by R. E. Bagley.

Syracuse Chapter. Dec. 21. "The Use of Ratios in the Analysis of Financial Statements," by M. Wall.

Twin Cities Chapter. Dec. 21. "How Advertising Reduces Costs," by Mac Martin and W. W. Wright.

Utica Chapter. Dec. 13. "The Use of Balance Sheets and Operating Statements," by C. O. Wellington.

Forthcoming Meetings

American Society of Mechanical Engineers. Annual meeting, New York City, Dec. 6 to 9. Calvin Rice, secretary, 29 West 39th St., New York.

National Exposition of Power and Mechanical Engineering. Fifth event, Grand Central Palace, New York City, Dec. 6 to 11. I. E. Moultrop, chairman advisory committee, Edison Electric Illuminating Co., Boston, Mass.

American Association for the Advancement of Science. Annual meeting University of Pennsylvania, Philadelphia, Pa., Dec. 27 to Jan. 1. Sam Woodley, executive assistant, Smithsonian Institution, Washington, D. C.

American Engineering Council. Annual meeting, Hotel Mayflower, Washington, D. C., Jan. 13 to 15. A. C. Oliphant, assistant secretary, 26 Jackson Place, Washington, D. C.

Society of Automotive Engineers. Annual meeting, Detroit, Jan. 25 to Jan. 28. W. Delchamps, chairman, meetings and sections department, 29 West 39th St., New York.

The Weekly Price Guide

Rise and Fall of the Market

WITH the fuel market weakening, pig-iron demand is noticeably slower in the New York and Youngstown districts; Birmingham and Chicago, however, show no tendency to slacken. The effect of recent fluctuations in the fuel and iron markets has been negligible so far as finished steel is concerned. Steel demand is slow with the exception of some recent active buying in steel plates and railway material. The general level of the non-ferrous metals market is slightly higher than a week ago. The minimum quotation on any of the principal heavy-rolled steel products is still $1.90 per 100 lb., Pittsburgh mill; ordinarily large tonnages of bars and shapes are $2 per 100 lb., while less-than-carload lots go at $2.10.

(All prices as of Nov..19)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.19
Northern Basic	20.89
Southern Ohio No. 2	21.39
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	26.37
BIRMINGHAM	
No. 2 Foundry	20.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	23.76
Virginia No. 2	28.19
Basic	21.26
CHICAGO	
No. 2 Foundry local	21.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	24.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.76
Basic	20.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00@5.25
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.40	3.50	3.25	3.89
No. 12	2.45	3.55	3.30	3.94
No. 14	2.50	3.60	3.35	3.99
No. 16	2.60	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.90	3.75	3.60	4.15
No. 22	3.05	3.90	3.75	4.30
No. 24	3.10	3.95	3.80	4.35
No. 26	3.20	4.05	3.90	4.45
No. 28	3.35	4.20	4.05	4.60
Galvanized				
No. 10	3.25	4.10	3.95	4.40
Nos. 12 to 14	3.35	4.20	4.05	4.50
No. 16	3.45	4.30	4.15	4.60
No. 18	3.60	4.45	4.30	4.75
No. 20	3.75	4.60	4.45	4.90
No. 22	3.80	4.65	4.50	4.95
No. 24	3.95	4.80	4.65	5.10
No. 26	4.20	5.05	4.90	5.35
No. 28	4.45	5.30	5.15	5.60

WELDED STEEL PIPE—Warehouse discounts are as follows

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv
1 to 3 in. steel butt welded.	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded.	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — Decimal	B.W.G. and Fractions	Outside Diameter in Inches — ¼	⅜	½	⅞	1	1⅛	1¼
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	6.00@7.50	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, ⅛", 8.35c.; ¼, 7.85c.; ½ to ½, 7.35c. per lb. *Flat, ⅛@¼-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.12½
Tin, 5-ton lots, New York			73.25
Lead (up to carlots) E. St. Louis	7.80	New York	8.62½
Zinc (up to carlots) E. St. Louis	7.27½	New York	8.25

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot.	15.50	18.50	15.00
Copper sheets, base	22.50	22.25	22.50
Copper wire, base	19.50	19.50	16.12½
Copper bars, base	22.12½	22.12½	22.12½
Copper tubing, base	24.50	24.50	24.50
Brass sheets, base	18.87½	18.87½	18.87½
Brass tubing, base	23.75	23.75	23.25
Brass rods, base	16.62½	16.62½	16.62½
Brass wire, base	19.37½	19.37½	19.37½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	27.00	27.00	27.02
Zinc sheets (casks)	13.25	13.05	12.01
Solder (½ and ½), (case lots)	42.75	44.50	38½@42½

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	90.00
Commercial genuine, intermediate grade	64.00
Anti-friction metal, general service	32.50
No. 4 babbitt (f.o.b.)	14.00

Nickel, f.o.b. refinery, cents per lb.:
Ingots..... 35.00 Electrolytic.. 39.00 Shot.....36.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.00 @12.25	11.25	11.00@11.50
Copper, heavy, and wire	11.00 @11.75	11.50	10.25@10.75
Copper, light, and bottoms	9 50 @10.00	9.75	9.25@ 9 75
Heavy lead	6 50 @ 7.00	6.75	6.50@ 7 00
Tea lead	4.50 @ 4.75	4.75	5.50@ 6.00
Brass, heavy, yellow	6 75 @ 7.25	7.25	6.75@ 7.25
Brass, heavy, red	9.25 @ 9.75	9.50	9.00@ 9.50
Brass, light	5.50 @ 6.00	6.25	6.00@ 6.50
No. 1 yellow rod turnings	7.75 @ 8.25	8.00	7.50@ 8.00
Zinc	4.25 @ 4.75	4.50	3 75@ 4 25

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8 00	6.00	7 50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0. 13@0. 17½	$0.18	$0.15@0 20
Cotton waste, colored, per lb.	.10@ .14	.13½	.12@.17
Wiping cloths, washed white, per lb	.17½	36.00 per M	.15
Sal soda, per 100 lb. keg	2.05	2.25	2.75*
Roll sulphur, per 100 lb.	2.70†	3.50	4.25‡
Linseed oil, per 7½-lb. gal., 5 bbl. lots	.86½	.98	84
Lard cutting oil, 25% lard, per gal.	.55	.50	48
Machine lubricant, medium-bodied (55 gal. metal bbl.), per gal.	.35	.35	29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

*Per 175 lb. keg. †In 150-lb. bags. ‡Per 425 lb. barrel.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.0415
Brass rods	per lb	.1662½	.1662½	.1737½
Solder (½ and ½)	per lb.	.4275	.4362½	.40
Cotton waste	per lb.	.13@ 17½	.13@.17½	15@22
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	7.00
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3 10	3.10	3.55
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	35	35	.35
Belting, leather, medium	off list	40–5%	40–5%	40%
Machine bolts, up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.40	$5. 84	$5.13
Emery paper	10. 71	11. 00	10. 71
Emery cloth	27.84	31. 12	27. 84
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1. 45	1. 32
Cloth	3.10	3. 50	3.05
Fire clay, per 100 lb. bag		.60	75
Coke, prompt furnace, per net ton	Connellsville,		4.75@5.25
Coke, prompt foundry, per net ton	Connellsville,		6 00@6.50
White lead, dry or in oil,	100 lb. kegs	New York,	15 25
Red lead, dry,	100 lb. kegs	New York,	15.25
Red lead, in oil,	100 lb. kegs	New York,	16 75

SHOP SUPPLIES

Machine bolts, ¾x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¾x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x¾-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ½x½-in., 2c. each. Discount 70% for $\frac{3}{16}$-in and smaller and 65% for ¼-in. and larger.
Case hardened ½x½-in., 6c. each, less 50%.

Rivets, button heads, ¾-in., ½-in., 1-in. diam. x2$\frac{3}{16}$-in. to 4½-in $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{3}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1¼ to 2-in. long, all diameters, 25c.; ¾-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb. 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ¾-in., $6.00* per 100 lb.

*For immediate delivery from warehouse

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ala., Sheffield—The King Co.—openside planer, 36 in. x 20 ft. bed.

Conn., New Britain—H. E. Morton, 132 Arch St.—miscellaneous tools and equipment including drill, etc. for proposed 2 story, 65 x 135 ft. repair and service garage. Estimated cost $100,000.

Md., Baltimore — Mallory Machinery Corp., 522 Light St.—10 ton overhead traveling crane, 60 ft. span, 3 ph., 25 cycle, 440 v. capacity.

Mass., Arlington (Boston P. O.)—J. Hurwitz, 40 Court St., Boston—miscellaneous tools and equipment for proposed 1 story, 140 x 155 ft. garage and repair shop on Massachusetts Ave. here. Estimated cost $75,000.

Mass., Boston—Wheels & Motor Service Inc., 100 Cummington St.—Greenerd arbor press, No. 3½.

Mass., New Bedford — W. Thompson, Second & High Sts.—miscellaneous tools and equipment for proposed repair and service garage.

Mass., Salem—Pitman & Brown—8, 10 or 12 in. straight moulder.

Mich., Detroit — Dodge Bros. Inc., Jos. Campau Ave.—is purchasing machinery and equipment for proposed 1 story, 200 x 1,632 ft. machine shop.

Mich., Detroit—Buhl Stamping Co., 2730 Scotten Ave. H. Hughes, Gen. Mgr. (light airplanes)—machinery and equipment for proposed extension to factory at Marysville.

Mo., Kansas City—W. A. Ross Construction Co., Railway Exchange Bldg.—miscellaneous tools and equipment for proposed plant, garage and machine shop. Estimated cost $75,000.

N. Y., Brooklyn—A.A. A. Art Metal Co., 2461 East 16th St.—Bliss 3C perforating press with automatic feed.

N. Y., Brooklyn—Mutual Electric & Hardware Mfg. Co., 28 Verandah Pl.—lathe, milling machine, shaper and punch press.

N. Y., Brooklyn—Sutter Marine Equipment Co., Ft. of East 92nd St.—32 to 36 in. band saw, 14 in. pattern lathe and 6 to 8 in. joiner.

O., Cleveland—The Vitreous Enameling Co., P. O. Box 1708—4 to 6 ft. power brake.

O., Marion—A. J. Seiter—woodworking machinery including 2 molders, 2 stickers, 2 cut off saws, 1 combination machine, etc. for mill now under construction.

Pa., Pittsburgh—John H. McCloy & Co., 418 Oliver Bldg.—alligator shear for shearing pipe up to and including 3 in.

Pa., Rochester—Guarantee Liquid Measure Co.—15 ton overhead electric crane.

Tex., Port Arthur — Standard Brass & Mfg. Co.—machinery and equipment for proposed addition to pattern making department. Estimated cost $75,000.

Wis., Kenosha — Regh's Auto Electric Service Co., 308 Exchange St.—grinder and lathe.

Wis., Racine — A. C. Gales, 1638 Villa St.—tools and equipment including lathe, etc., for proposed 2 story, 40 x 95 ft. machine shop.

Wis., West Allis—Lex Construction Co., 446 68th Ave.—machinery for the repair of paving equipment for proposed 1 story, 62 x 160 ft. service shop on 82nd St.

Opportunities for Future Business

Ark., Stuttgart—Starley White's Machine Works, awarded contract for the construction of a 1 story, 80 x 140 ft. machine shop on East Second and Cotton Belt R.R.

Calif., Los Angeles—City will build a 1 story, 30 x 400 ft. shop at Griffith Park. Estimated cost $40,000.

Calif., San Francisco—Bowie Switch Co., Wells Fargo Bldg., had plans prepared for the construction of a 2 story machine shop at 19th and Tennessee Sts. Estimated cost $25,000. A. Nordin, Mills Bldg., Archt.

Calif., San Jose—Pacific Gas & Electric Co., 245 Market St., San Francisco, is receiving bids for the construction of a group of 1 story buildings including garages and machine shops at Linden and Stockton Sts. here. Estimated cost to exceed $50,000. Private plans.

Ga., Gainesville—Chicopee Mfg. Co., Inc., Chicopee Falls, Mass., awarded contract for the construction of a plant including 1 story, 110 x 190 ft. machine shop and supply house, etc., here. Estimated total cost $3,000,000.

Ga., Macon—Taylor Iron Works & Supply Co., 1014 Broadway, plans the construction of a plant.

Ill., Chicago—Sanitary Dist., 910 South Michigan Ave., awarded contract for the construction of repair shops, garage, etc. Noted July 29.

Ind., Evansville—Louisville & Nashville R.R. Co., Louisville, Ky., awarded contract for the construction of a round house and machine shop. Estimated cost $200,000. Noted Nov. 4.

Ia., Cedar Rapids—Speeder Machinery Co., Fairfield, awarded contract for the construction of a 1 story, 144 x 164 ft. factory at 1201 South 6th St. W. here. Estimated cost $43,000.

Mass., Boston—B. Krivitsky, 217 Albany St., (iron work), will build a 3 story addition to factory at Seneca and Albany Sts. Estimated cost $40,000. B. S. Brown, 65 Franklin St., Archt.

Mass., Quincy (Boston P. O.)—Norfolk Woodworking Co., 53 Wyman Rd., Braintree, is having plans prepared for the construction of group of buildings including a 60 x 140 and 140 x 260 ft. mill, 30 x 40 ft. garage, 50 x 110 ft. lumber storehouse, etc. all 1 story, at 265-289 Hancock St. here. Estimated cost $200,000. L. J. Joslin, 339 Newbury St., Boston. Archt.

Mass., Somerville (Boston P. O.)—Cambridge Machine & Tool Co., 234 Washington St., awarded contract for the construction of a 1 story, 40 x 100 ft. machine shop at Medford and Washington Sts.

Mass., South Boston (Boston P. O.)—Andrew Sq. Terminal Co. Inc., F. A. Kamp, 53 State St., Boston, is having plans prepared for the construction of a 3 story, 200 x 300 ft. garage on Dorchester Ave. here. Estimated cost $1,000,000. R. M. Stowell, 184 Boylston St., Boston, Archt. H. S. Cleverdon, 184 Boylston St., Boston, Engr.

Mass., South Boston (Boston P. O.)—K. De Pietro, 424 Hanover St., will build a 1 story, 145 x 190 ft. repair and service garage at 45 West Third St. Estimated cost $80,000. F. A. Norcross, 46 Cornhill, Boston, Archt.

Mass., Worcester—Boston & Albany R.R. Co., South Station, Boston, awarded contract for the construction of a 1 story machine shop, coaling plant, etc., here. Estimated cost $600,000.

Mass., Winthrop (Boston P. O.)—McNeil Bros., 195 Lincoln St., awarded contract for the construction of a 1 story repair shop on Bowdoin St. Estimated cost $40,000.

Mich., Detroit—A. Kahn, 1000 Marquette Bldg., Archt., is receiving bids for the construction of a 1 story, 200 x 1,632 ft. machine shop on Lynch Rd. for Dodge Bros. Inc., Jos. Campau Ave.

Miss., Jackson—Wright Roofing & Metal Works, manufacturers of sheet metal products, plans the construction of a plant. Estimated cost $30,000. Private plans.

Mo., Kansas City—T. F. Brogham, 3009 Benton Blvd., awarded contract for the construction of a 1 story, 200 x 211 ft. garage at Independence and Woodland Aves. Estimated cost $85,000.

Mo., St. Louis—William Wurdack Electric Mfg. Co., 21 South 11th St., awarded contract for the construction of a 1 and 2 story, 22 x 27 and 100 x 122 ft. electric manufacturing plant on Clayton Ave. Estimated cost $150,000.

N. J., Camden—Keystone Supply & Mfg. Co., 927 North 9th St., Philadelphia, Pa., manufacturers of plumbers' supplies, awarded contract for the construction of a 1 story, 96 x 100 ft. pipe shed here. Noted Nov. 4.

N. Y., Middletown—New York Ontario & Western Ry. Co., will build an 80 x 356 ft. car repair shop. Estimated cost $60,000. W. C. Heidenthal, Ch. Engr.

N. Y., New York—East Fordham Syndicate Inc., c/o T. S. Parker, 280 Madison Ave., Archt., is having plans prepared for the construction of a repair shop, garage and service station on Belmont Ave. Estimated cost $150,000.

O., Cleveland—The American Stove Co., J. G. Way, Mgr., 4301 Perkins Ave., had plans prepared for the construction of a 1 story, 50 x 200 ft. factory on Hough Ave. Estimated cost $60,000. Carter-Richards Co., Engineers Bldg., Archt.

O., Cleveland — Appalachian Hardwood Lumber Co., 5100 Brookpark Rd., awarded contract for the construction of a mill.

O., Cleveland—F. Lipman, 6201 Woodland Ave., manufacturer of metal beds, awarded contract for the construction of a 1 story, 37 x 100 ft. addition to factory. Estimated cost $40,000.

O., Columbus—Yardley Screen & Weatherstrip Co., 715 Gustarus Lane, awarded contract for the construction of a 1 story, 100 x 320 ft. factory on Essex Ave. Estimated cost $52,814.

O., Kent—The Lamson & Session Co., J. Jennings, 2188 Scranton Rd., Cleveland, manufacturers of bolts, rivets and wire rope clips, will soon award contract for the construction of a 1 story, 45 x 90 ft. pickling building here. Estimated cost $40,000. George S. Rider Co., Century Bldg., Cleveland, Archt.

Pa., Chester—S. P. Stevenson, 1500 West 4th St., manufacturers of cold storage doors, will soon award contract for the construction of a 1 story, 80 x 130 ft. addition to plant on Filghman St. Ballinger Co., 12th and Chestnut Sts., Philadelphia, Archt.

Pa., Derry—Westinghouse High Voltage Insulator Co., is receiving bids for the construction of a 1 story, 100 x 450 ft. manufacturing plant. Estimated cost $100,000. B. H. Prack, Martin Bldg., Pittsburgh, Archt.

Pa., Philadelphia—Babis & Bender Construction Co., Schubert Bldg., will build a 2 story, 50 x 100 and 25 x 170 ft. garage and service station at 1418 South 7th St. I. W. Levin, Jefferson Bldg., Archt.

Pa., Philadelphia—Langshaw Motor Co., 1135 South 58th St., awarded contract for the construction of a 2 story, 50 x 120 ft. repair and service garage.

Pa., Philadelphia—R. L. Binder Metal Coatings Co., 497 North 3rd St., manufacturers of electrical supplies, will soon award contract for the construction of a 5 story, 30 x 100 ft. factory at American and Buttonwood Sts. E. A. Stopper, 10 South 18th St., Archt. Noted Nov. 11.

Pa., Philadelphia—Imperial Type Metal Co., W. S. Yeager, Howard St., manufacturers of printers' equipment and supplies, awarded contract for the construction of a 1 story plant.

Pa., Pittsburgh—The Hubbard Co., Butler St., shovel manufacturers, awarded contract for the construction of a 1 story addition to plant. Estimated cost $150,000.

R. I., Auburn—General Fire Extinguisher Co., manufacturers of chemical extinguishers, awarded contract for the construction of a 1 story, 200 x 204 ft. plant. Estimated cost $40,000.